Computed Tomography of the Brain in Trauma Patients With Alcohol Intoxication and Brain Injuries

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Background. Alcohol intoxication is known to be associated with increased probability of traumatic injury. Although, the Glasgow coma scale (GCS) and computed tomography (CT) of the brain are useful diagnostic tools in patients with head injuries, the interactions among blood alcohol concentration (BAC), Glasgow coma scale and computed tomography findings are not clear.

Methods. This study included 109 patients with head injuries and alcohol intoxication. Forty-three patients (group I) had blood alcohol concentrations less than 50 mg/dl, and 66 patients (group II) had blood alcohol concentrations more than 50 mg/dl. All the patients had neurological examination using the mean of GCS, blood alcohol concentration and CT of brain upon admission to the emergency department.

Results. There were similar score of GCS (10.1 ± 3.4 *vs* 10.1 ± 3.2) and incidence of positive CT findings (60% *vs* 50%) between the two groups. In group I, the patients with a low GCS (< 11 points) had higher incidence of positive brain CT findings than the patients with a high GCS (≥ 11 points) (22% *vs* 88%, $p < 0.05$). In group II, there was a similar incidence of positive brain CT findings between the patients with low and high GCS (42% *vs* 60%, $p > 0.05$).

Conclusions. The results of this study demonstrate different results of GCS and brain injury in patients with a low or high blood alcohol concentration. Our results suggest that brain CT scan is a strong indicator for trauma in patients with lower blood alcohol and lower GCS scores. **(Mid Taiwan J Med 2000;5:162-6)**

Key words

alcohol, computed tomography, Glasgow coma scale

INTRODUCTION

Alcohol intoxication is known to be associated with increased probability of traumatic injury [1-3]. The effects of alcohol in precipitating trauma arise from the diminished motor coordination and inability to perform cerebral tasks. Previous studies have demonstrated that there is a consistent and significant relationship between alcoholism and all types of trauma [4]. Therefore, it is important to determine blood alcohol concentration in all trauma and accident patients. In addition, both alcohol intoxication and head injury may produce altered mental status and make differentiation difficult. Therefore, alcohol intoxication associated with head injury is still challenge to physicians in the emergency department not only in impaired coordination but also in clinical survey. It may put a physician at legal risk both for improper care of the patient and for exposing others to injury if patient crashes after discharged, while still impaired by

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alcohol. The criteria that warrant an emergency computed tomography (CT) scan of the brain in patients with minor head injuries and alcohol ingestion still present a clinical problem. Routine CT scan for minimal head injury patients is unnecessary [5].

The Glasgow coma scale (GCS) is a good way to evaluate the level of consciousness in trauma patients [6]. Previous studies have indicated that GCS may be influenced by alcohol intoxication [7]. In patients with alcohol intoxication, it was difficult to evaluate the severity of brain injury using GCS, because alcohol depressed consciousness and GCS scores in these patients. Computed tomography of the brain is a useful adjunct diagnostic tool, however, the cost is relatively high. The interactions among blood alcohol level, GCS and CT findings have not been clarified. Therefore, the purpose of the study was to investigate the effects of blood alcohol concentration on the findings of GCS and CT of the brain.

MATERIALS AND METHODS

A prospective cohort study was conducted at China Medical College Hospital from August 1997 through May 1998. Patients with clinically suggested ethanol intoxication and head injury within 8 hours of admission were entered into this study. History of alcohol consumption was obtained from family, friends, bystanders, or paramedics, as well as the patient. All the patients received alcohol level, conscious level, and brain CT examinations. The GCS scores were routinely included in the neurological examination. The GCS values were recorded on arrival and blood for the blood alcohol concentration was drawn at the same time. Brain CT scans followed. Since medications (primarily barbiturate, opiates, and tranquilizers) might lower the GCS, the patients who had taken medications were precluded in this study.

The patients with blood alcohol concentration (BAC) more than 10 mg/dl were assumed to have ingested alcohol recently. The patients were divided into two group based upon the level of blood alcohol concentration of either lesser than 50 mg/dl or more than 50 mg/dl. These two groups were compared according to age, sex, conscious level, BAC and incidence of positive brain CT. Statistical differences were analyzed using Chi-squared test.

RESULTS

There were 109 patients, including 95 men and 14 women. There were 21 patients with blood alcohol concentrations less than 10 mg/dl; 10 mg/dl to 100 mg/dl, 28 patients; 100 to 200 mg/dl, 21 patients; 200 mg/dl to 300 mg/dl, 28 patients and more than 300 mg/dl, 11 patients. Trauma mechanism included motor vehicle accident for 79 patients (72%), falls for 12 patients (11%), violent attack for 11 patients (10%) and other causes for seven patients (7%).

In group 1, there were 43 patients with blood alcohol concentration less than 50 mg/dl. In group 2, there were 66 patients with blood alcohol concentration more than 50 mg/dl. Table 1 shows the patients' characteristics in group I and group II patients. In group I patients, the blood alcohol concentration was significantly lower (10.0 ± 8.7 *vs* 206 ± 7.2, $p < 0.0001$) than that in group II patients. The age (31 ± 16 *vs* 35 ± 12 years),

Table 1. Patient characteristics

	Group I	Group II	*p* value
Age (years)	31 ±16	35 ±12	NS
Sex (male/female)	35/8	60/6	NS
GCS	10.1 ±3.4	10.1 ±3.2	NS
Blood alcohol concentration	10.0 ±8.7	206.0 ±72.6	< 0.0001
Incidence of positive brain CT	60%	50%	NS

NS = non-significant; GCS = glasgow coma scale; CT = computed tomography.

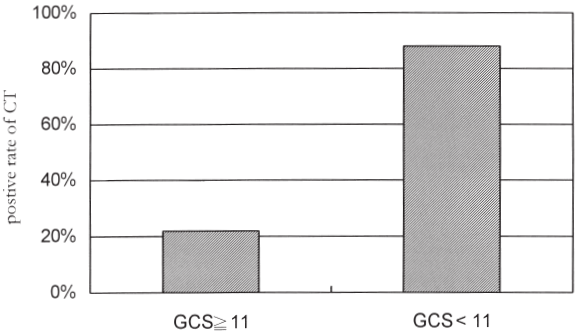

Fig. 1 Incidence of positive brain CT in the patients with a high (≥11) and low (<11) GCS in group I (BAC<50 mg/dl).

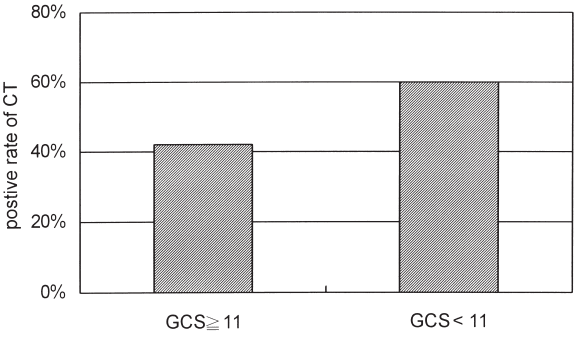

Fig. 2 Incidence of positive brain CT in the patients with a high (≥11) and low (<11) GCS in group II (BAC≥50 mg/dl).

gender ratio, GCS (10.1 ± 3.4 *vs* 10.1 ± 3.2) and incidence of positive CT findings (60% *vs* 50%) were similar between the two groups.

In group I , 18 patients had GCS equal to or more than 11 points and 25 patients had GCS less than 11 points. Four (22%) patients with higher GCS (≥ 11 points) had positive brain CT scans, which was significantly lower than the incidence (88%, Fig. 1) of the patients with lower GCS (< 11 points). In group II, 36 patients had GCS equal to or more than 11 points and 30 patients had GCS less than 11 points. Fifteen (42%) of the patients with higher GCS (≥ 11 points) had positive brain CT scans. The incidence of positive brain CT scans was similar between the patients with lower or higher GCS (60%, Fig. 2).

DISCUSSIONS

The results of this study demonstrated that the patients with different degrees of alcohol intoxication and trauma may have similar levels of consciousness. In patients with low alcohol concentration associated with traumatic injury, the patients with low GCS had higher incidence of brain damage than the patients with high GCS. Nevertheless, in the patients with high blood alcohol concentration associated with traumatic injury, there was similar incidence of brain damage between the patients with low and high GCS. One surprising finding from this study was the BAC was less than 10mg/dl in 21 patients. Strictly speaking, these patients did not consume alcohol before trauma accidents. The history of drinking was acquired from emergency medicine technicians, bystanders or sometimes paramedics. The incomplete information may have been wrong and led emergency physicians misdiagnose or mismanage the patients. This is why routine BAC testing in emergency rooms should be done, especial for patients with distinct levels of consciousness or unclear drinking history.

Alcohol intoxication has a great impact on the practice of medicine in the emergency department. Many patients who come to the emergency department have been drinking recently and may have illnesses or injuries related to alcohol intoxication or ingestion. It is known that alcohol intoxication is the most common associated illness in trauma patients [8-10]. Because alcohol increases the frequency and severity of traumatic injuries, it is important to evaluate the blood alcohol concentration in patients suggestive of alcohol intoxication. Additionally, quantitative testing for alcohol can be extremely important in the differential diagnosis and the analysis of prognosis. It has been proposed that patients with head-injuries related to alcohol consumption seem to recover more quickly than patients with head injuries not related to alcohol consumption because part of the apparent damage at impact was due to the pharmacological effect of the alcohol [11]. Repeat test of alcohol levels are important components of the diagnoses and management of intoxicated patients [12]. In addition, alcohol abuse is associated with an

increased risk of readmission due to new trauma, it is important to screen for alcohol and refer those patients for appropriate care to decrease their risk of readmission due to subsequent trauma [13].

Alcohol intoxication alters consciousness and it is often impossible to determine whether and to what extent the patient has altered sensations due to trauma or the pharmacological effects of alcohol [14]. Although, intoxication of alcohol correlates roughly with blood concentration [15], there is a wide individual variability and chronic alcoholics can exhibit impressive tolerance. In this study, the patients with a higher or lower blood alcohol concentration had similar GCS. This suggests that it is not possible to determine with any degree of certainty the blood alcohol concentration of a person in the absence of a quantitative test.

Head trauma is one of the most serious causes of change in mental status and may be devastating if the correct diagnosis is missed. Alcoholic patients are predisposed to trauma. Researchers doing head injury studies often use the initial GCS to assess patients according to severity [6]. Because such measures of level of consciousness are altered by alcohol, some intoxicated patients are misclassified. Therefore, it is recommended that CT scans may be performed on the patients with deteriorating mental status, focal neurologic findings, and failure to improve over time. Nevertheless, the effects of GCS on the use of brain CT were never evaluated in patients with low or high level of alcohol intoxication. In this study in the patients with high blood alcohol concentrations (≥ 50 mg/dl), there were similar incidence of positive CT findings between the patients with a high or low GCS. However, in the patients with low blood alcohol concentrations (< 50 mg/dl), the incidence of positive CT findings was lower in patients with high GCS than in those with low GCS. These findings suggest that in patients with high blood alcohol concentrations, GCS was useless in evaluating the severity of brain damage. In contrast, in patients with low blood alcohol levels, GCS was useful in evaluating the risk of brain injury, whereas patients with low value GCS had very high possibility of brain damage (up to 88% diagnosed using brain CT).

In conclusion, the results in this study demonstrated the relationship among blood alcohol level, GCS and brain CT scans. Our results suggest that brain CT scans are strong indications for traumatic patients with lower blood alcohol and lower GCS score.

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酒精濃度在創傷病患合併頭部創傷的角色

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背景 飲用酒精後已證實會增加創傷的機會，雖然昏迷指數（GCS）及頭部電腦斷層對頭部外傷病患是十分有用的診斷工具，但血液酒精濃度、昏迷指數及頭部電腦斷層之間的關係仍然不清。

方法 本研究對109位病患因飲酒合併頭部外傷進行分析，第一組有43位病患，其血液酒精濃度小於50 mg/dl，第二組有66位病患，其血液酒精濃度大於50 mg/dl，所有病患在進急診室後均接受神經學理學檢查及頭部電腦斷層檢查。

結果 結果顯示兩組病患的昏迷指數GCS (10.1 ±3.4 比10.1 ±3.2)及電腦斷層出現陽性反應比率（60%比50%）的情形相似，但在第一組病患中昏迷指數GCS＜11 分其電腦斷層出現陽性反應的比率比昏迷指數GCS ≧11分的高（22% 比88%, $p < 0.05$ ），而第二組的病患不論昏迷指數高或低，其電腦斷層出現陽性反應的比率是相似的（42%比60%, $p > 0.05$ ）。

結論 本研究顯示不同酒精濃度對昏迷指數及頭部損傷的影響，但對血液低酒精含量及低昏迷指數的創傷病患，安排頭部電腦斷層是很適當的時機。（中台灣醫誌 **2000;5:162-6**）

關鍵詞

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