STUDY ON THE EFFECTS OF EARLY MENTAL DISORDERS CAUSED BY ACUTE CRANIOCEREBRAL INJURY AND NURSING OBSERVATION

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ABSTRACT

Purpose*: The specific conditions of patients with acute craniocerebral injury, the extent, location, nature of the injury, and the association of the occurrence of mental disorders were analyzed. The specific changes of IL-1β, IL-6, TNF-a and cortisol in the serum of patients with early mental symptoms caused by acute craniocerebral injury were monitored.*

Method*: 275 patients with acute craniocerebral injury were selected from Tangshan Gongren Hospital. The patient's relevant information was sorted out. The effects of multiple factors on early mental symptoms in patients with acute craniocerebral injury were analyzed. Peripheral venous blood samples were collected on the first day, the third day, the seventh day, the 15th day, the 21st day, and the 30th day of the hospitalization. Serum levels of IL-1β, IL-6, TNF-a and cortisol were measured by enzyme-linked immunosorbent assay (ELISA) and their specific trends were compared.*

Result*: The degree of education, age and specific nature, location and extent of traumatic brain injury were correlated with the occurrence of early psychiatric symptoms (P<0.01). Compared with patients in the non-mental disorder group, there was no change in the serum IL-1β, IL-6, and TNF-a levels on the first day after the injury in the mental disorder group. However, on the 3rd, 7th, 15th, 21st, and 30th days after the injury, the relevant index of the mental disorder group was higher than that of the non-mental disorder group (P<0.05). The indicators of the mental disorder group reached a peak on the 7th day after the injury and then gradually decreased.*

Conclusion*: During clinical treatment of patients with craniocerebral injury, high-risk patients should be evaluated in a targeted manner. At the same time, the patient's mental symptoms should be observed and some targeted interventions and treatments should be carried out. The serum levels of IL-1β, IL-6, TNF-a and cortisol were monitored dynamically. This provides guidance for clinical evaluation of the occurrence, development and observation of early mental symptoms of acute craniocerebral injury and has very high clinical value.*

Keywords*: acute craniocerebral injury, early mental disorder, cytokines, cortisol.*

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Introduction

Head injury is a common trauma in the clinic. The probability of occurrence ranks second in systemic trauma, and its probability of causing death and disability ranks first. It has the characteristics of high incidence, high disability rate and high mortality[(1)]. Mental disorders may occur after craniocerebral injury, which is one of the most serious complications after craniocerebral injury[(2)]. Mental disorder caused by craniocerebral injury refers to the direct or indirect effect of external force on the brain, resulting in mental abnormalities occurring in organic or functional disorders of the brain.

A mental disorder, also called a mental illness or psychiatric disorder, is a behavioral or mental pattern that causes significant distress or impairment of personal functioning. Such features may be persistent, relapsing and remitting, or occur as a single episode[(3)]. This not only increases the likelihood of accidents in patients, but also makes clinical care more difficult. It will affect the treatment of craniocerebral injury[(4)].

Craniocerebral injury can cause serious trauma to the human body and spirit. This damage is generally long-term and destructive. Mental disorders caused by craniocerebral injury usually occur from 1 day to 4 weeks after craniocerebral injury, and some-

times it will be longer. Related studies at home and abroad have confirmed that the possibility of mental disorders after craniocerebral trauma is significantly higher than that of ordinary people, and the probability of occurrence is as high as 70%[5]. The clinical manifestations of mental disorders caused by craniocerebral injury are very complicated. Acute mental disorders usually manifest as mental confusion, disturbance of consciousness, and manic state after injury, irritability and impulsive behavior[6].

At present, the related research on mental disorders caused by craniocerebral injury is mainly the research and observation of the late stage of craniocerebral injury, but there are few studies on the mental state of early patients after injury. The clinical treatment of mental disorders is generally treated after the symptoms appear. No objective indicators help the diagnosis of early mental disorders. The incidence and risk factors of early mental disorders in acute craniocerebral injury were analyzed. Normative and predictive observational indicators were established to aid clinical prevention, early diagnosis, and targeted care. The relationship between the time of onset of psychotic symptoms and serological changes was analyzed, and the correlation and trends between them were sought, which is very beneficial for clinical nursing observation.

Materials and methods

Experimental materials

Research object

275 adult patients with acute craniocerebral injury in the Department of Emergency Surgery from September 2016 to December 2017 were selected. There were 184 male patients and 91 female patients. The age of the patients was 21-79 (45.1±7.9) years old. Informed consent was obtained for all subjects in the study, and the study was approved by the Ethics Committee of Tangshan Gongren Hospital.

Inclusion and exclusion criteria

Inclusion criteria:

• Go to the hospital within 24 hours after injury;

• With a history of trauma, the patient is identified as a head injury by imaging examinations such as CT and MR;

• Age is between 18-80 years old.

Exclusion criteria:

• Those who are unable to assess and analyze mental disorders or who are unwilling to cooperate with this study;

• Those who have taken antipsychotic drugs or similar drugs;

• A history of mental illness or family history of mental illness;

• Repeatedly brain injuries;

• The age is not 18-80 years old;

• Patients with injuries to other parts of the body;

• suffering from chronic medical diseases such as primary hyperthyroidism, diabetes, hypertension and other patients.

Experimental method

Data collection

The patient's condition was summarized using a self-made admission assessment form, a mental symptom assessment form, and a clinical observation evaluation form. The basic conditions of the patient include: gender, education level, age, occupation, marital status, family history, history, medication history. Trauma: the location of the injury, the cause of the injury, the extent of the injury, the type of injury (GCS score, ISS score). Treatment: Whether the patient has undergone surgery or whether he has taken some special drugs. Psychiatric symptoms: the time, performance, and duration of symptoms.

Patient grouping

According to the diagnostic criteria for organic mental disorders in CCMD-3, the diagnosis and treatment physician, clinical psychologist, and psychiatrist assess the mental symptoms according to the clinical. Patients were divided into mental disorders (MD group) and non-mental disorders (NMD group).

Specimen collection and processing

All enrolled cases were numbered according to the time of admission. According to the method of the hundred-digit numbering, i.e. **1, for example, the patient number of the first group is 001, and so on. Six time points of the first day, the third day, the seventh day, the fifteenth day, the twenty-first day and the 30th day were selected. The patient''s number and specific vital signs were recorded on a self-made clinical observation evaluation form for patients with acute craniocerebral injury. At 08:00 in the morning, each patient took 5 ml of peripheral venous blood within 24 hours, 3rd day, 7th day, 15th day, 21st day and 30th day after trauma, and placed in the coagulation test tube. The sample was allowed to stand at room temperature for 15 min, centrifuged

at 3000 r/min for 15 min at room temperature, and the serum samples were separated, and two tubes were dispensed. The names, numbers, treatment methods, time, etc. were marked and stored in a refrigerator at -70 °C for later use. The reagents were human IL-1β, human IL-6, human TNF-a and human cortisol ELISA kits. The kits were purchased from R&DS ystems, USA, and monitored strictly according to the requirements of the instructions.

Major reagents

• Human interleukin-1β (IL-1β) ELISA kit was purchased from American R&D Company;

• Human interleukin-6 (IL-6) ELISA kit was purchased from American R&D Company;

• Human tumor necrosis factor-a (Tumornecrosis factor-a, TNF-a) ELISA kit was purchased from American R&D Company;

• The human cortisol (Cortisol) ELISA kit was purchased from R&D, USA.

Statistical method

Data statistics were analyzed using SPSS 17.0 statistical software. Data is represented as x±s. The t test was used for data comparison. A probability $P < 0.05$ indicates that the data difference analysis between groups is statistically significant.

Result

Of the 275 patients with acute head injury, 193 were mentally ill and the incidence of mental disorders was 70.2%. Mental disorders have a variety of clinical manifestations. Among them, 91 cases were disturbance of consciousness, 31 cases were affective disorder, 44 cases were for amnesia syndrome (forgotten after trauma), 9 cases were intelligent damage, 6 cases were personality changes, 9 cases were psychotic symptoms and 3 cases were neurotic symptoms. The main symptoms are disturbance of consciousness, irritability, forgetting, coma, paralysis and so on.

The statistical description of patients with acute craniocerebral injury is shown in Table 1.

As can be seen from Table 1, in the 193 MD group, men and women had a higher incidence of mental disorders. It showed a significant difference (χ^2=22.357, P<0.01). The age distribution shows that there are more patients between the ages of 40-60 than in other age groups. The difference is statistically significant (χ^2=22.357, P<0.01). Patients with lower education levels are more likely to develop mental disorders. It showed a significant difference (χ^2=13.247, P=0.01). Physical workers are more likely to suffer from mental disorders than mental workers and have significant differences (χ^2=9.469, P=0.02).

		MD(n=193)	NMD(n=82)	χ2	P
Sex	Male	146	36	22.357	< 0.01
	Female	47	46		
Age	20-40	65	34	20.642	< 0.01
	40-60	111	27		
	60-80	17	21		
Degree of Education	Junior middle school and below	113	35	13.247	0.01
	High school and secondary school	57	22		
	College and above	23	25		
Profession	Muscular labor	150	49	9.469	0.02
	Mental labor	43	33		

Table 1: Statistical description of mental disorders in patients with acute craniocerebral injury.

The relationship between the nature of craniocerebral injury and associated mental disorders is shown in Figure 1.

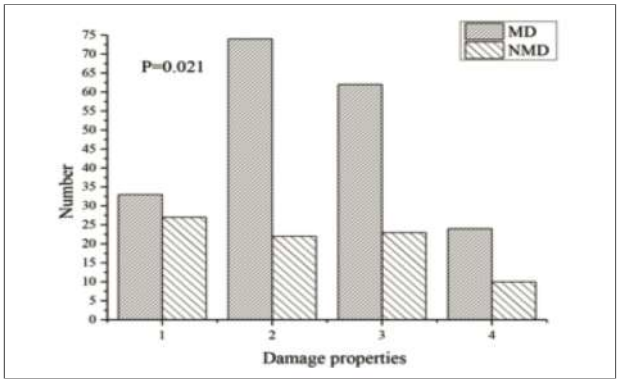

Fig. 1: The relationship between the nature of craniocerebral injury and the associated mental disorder (1,2,3 and 4 represent concussion, brain contusion, intracranial hematoma and skull base fracture, respectively).

As can be seen from Figure 1, there were significant differences in patients with different injury types in the dysfunction group (χ^2=9.836, P=0.021<0.05). Most of them were cerebral contusion and intracranial hematoma. The number of people in group MD was 74 and 61, accounting for 39% and 32% respectively. The number of people in group NMD was 21 and 22, accounting for 26% and 28% respectively.

The relationship between the degree of craniocerebral injury and associated mental disorders is shown in Figure 2.

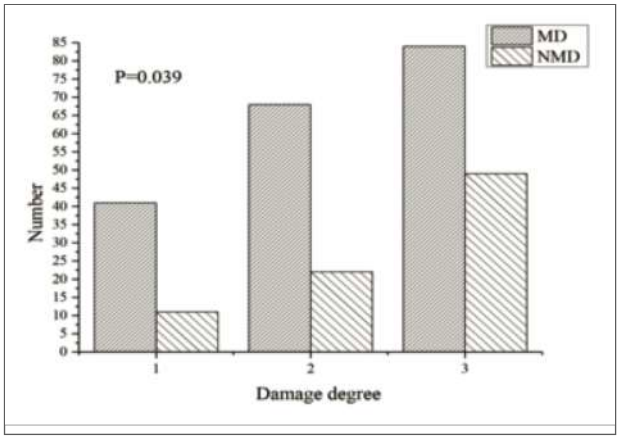

Fig. 2: The relationship between the degree of craniocerebral injury and the associated mental disorder (1,2 and 3 represent mild injury, moderate injury and severe injury, respectively).

For the degree of damage, there was a significant difference between the different degrees of damage (χ^2=6.845, P=0.039<0.05). Patients with severe head injury are more likely to develop psychiatric symptoms than patients with mild injuries. The number of mild, moderate, and severe injuries in the group MD was 40, 66, and 84, accounting for 21%, 35%, and 44%, respectively. The number of mild, moderate, and severe injuries in the group NMD was 10, 21, and 48, accounting for 12%, 27%, and 61%, respectively.

The relationship between the location of the brain injury and the associated mental disorder is shown in Figure 3.

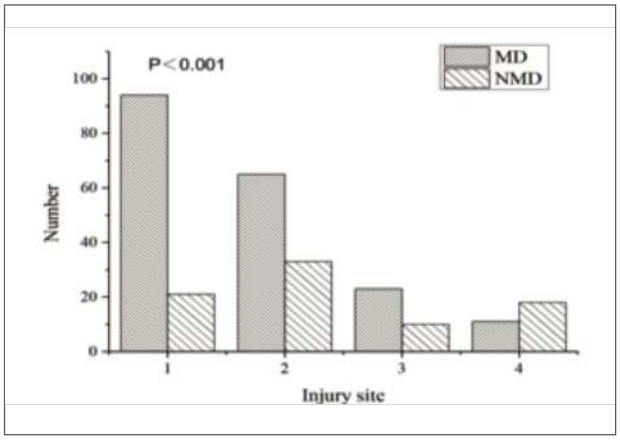

Fig. 3: The relationship between the location of craniocerebral injury and the associated mental disorder (1, 2, 3, and 4 represent frontal lobe injury, temporal lobe injury, frontal lobe with temporal lobe injury, and other site injuries).

It can be seen that patients with mental disorders have significant differences due to different lesion sites (χ^2=21.725, P<0.001). The main damage sites are the frontal lobe and the temporal lobe. The number of frontal and temporal lobe injuries in the group MD were 94 and 66, respectively, accounting for 48% and 34%. The number of frontal and temporal lobe injuries in the group NMD were 20 and 32, respectively, accounting for 25% and 40%.

The patient's basic information is assigned: Age (1=20-40 years old, 2=40-60 years old, 3=>60 years old), Gender (1=male, 0=female), Education level (1 = junior high school and below, 2 = high school and secondary school, 3 = college and above), Occupation (1 = manual labor, 0 = mental work), The nature of craniocerebral injury (1 = concussion, 2 = brain contusion, 3 = intracranial hematoma, 4 = skull base fracture), Degree of damage (1 = mild, 2 = moderate, 3 = severe), Injury site (1 = frontal lobe, 2 = temporal lobe, 3 = frontal lobe), Then, the candidate variables of Logistic multivariate regression analysis were included. The results showed that age, gender, degree of craniocerebral injury, frontal lobe and temporal lobe injury, and multi-leaf joint injury were risk factors for craniocerebral injury with mental disorders, as shown in Table 2.

Parameter	β	P	OR	OR 95% CI	
				Lower	Up
Age	-1.186	0.001	1.428	0.955	3.387
Degree of injury	2.187	0.032	7.485	2.639	21.174
Frontal lobe injury	1.639	0.002	0.247	0.062	0.481
Temporal lobe injury	4.147	0.018	60.235	15.872	240.482
vitreous blood	2.946	< 0.021	17.945	5.184	63.571
Frontal and temporal lobe injury	3.742	< 0.004	37.744	7.916	181.582

Table 2: Multivariate analysis of factors associated with mental disorders in patients with craniocerebral trauma.

The comparison of serum IL-1β levels between patients with mental disorders and non-mental disorders is shown in Figure 4 and Table 3.

The multi-factor analysis of variance was used to compare the levels of serum IL-1β at each time point, and F=7.218, P=0.02, (p<0.05). The difference of serum IL-1β between the mental disorder group and the non-mental disorder group was statistically significant. Serum IL-1β levels were compared at each time point in both groups by independent sample t-test. There was no significant difference in IL-1β between the two groups on the first day after

injury (p>0.05). After injury, the difference between the two groups on the 3rd day, the 7th day, the 15th day, the 21st day, and the 30th day was statistically significant (p<0.05). IL-1β began to rise on the first day after injury, peaked on the 7th day after injury, and then began to decline, but it was still higher than the non-mental disorThe multi-factor analysis of variance was used to compare the levels of serum TNF-a at each time point, and F=7.946, P=0.014, P<0.05. It showed that there was a statistically significant difference in serum TNF-a between the mentally disabled group and the non-mental disorder group. Serum TNF-a levels were compared at various time points in both groups by independent sample t-test. There was no significant difference in TNF-a between the two groups on the first day after injury (P>0.05). After injury, the difference between the two groups on the 3rd day, the 7th day, the 15th day, the 21st day, and the 30th day was statistically significant (P<0.05). TNF-a began to rise on the first day after injury, peaked on the 7th day after injury, and then began to decline, but it was still higher than the non-mental disorder group (P<0.05).

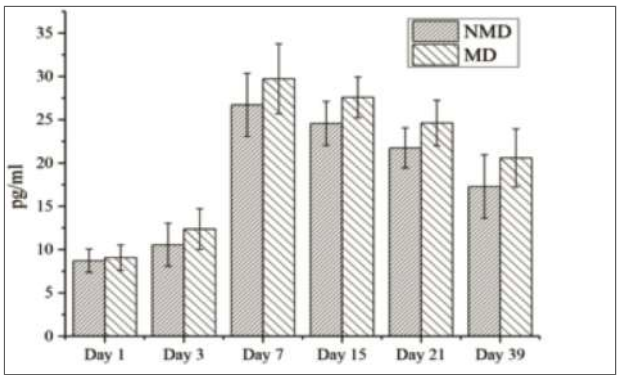

Fig. 4: The relationship between the location of craniocerebral injury and the associated mental disorder.

Day	t	P
Day1	14.327	0.1564
Day3	51.583	< 0.001
Day7	61.942	< 0.001
Day15	83.952	< 0.001
Day21	89.364	< 0.001
Day30	77.327	< 0.001

Table 3: Changes of serum IL-1 beta in two groups of patients.

The serum cortisol levels of the patients in the mental disorder group and the non-mental disorder group are shown in Table 6 and Figure 7.

The serum IL-6 levels in the patients with mental disorders and non-mental disorders are shown in Table 4 and Figure 5.

Day	t	P
Day1	0.8493	0.4827
Day3	49.275	< 0.001
Day7	214.726	< 0.001
Day15	94.872	< 0.001
Day21	257.827	< 0.001
Day30	189.476	< 0.001

Table 4: Changes of serum IL-6 beta in two groups of patients.

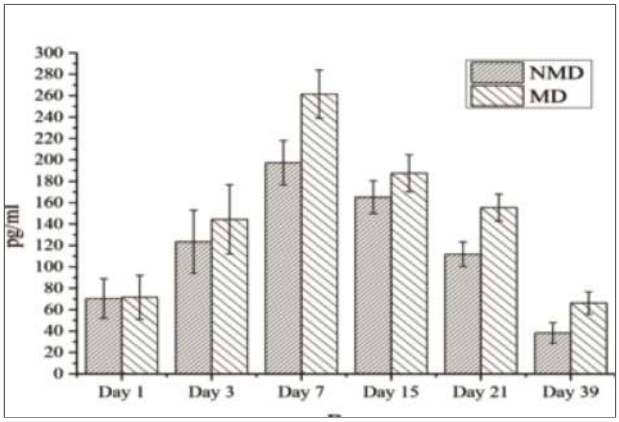

Fig. 5: Comparison of different phase points of serum TNF-a in two groups of patients.

By comparing the levels of serum IL-6 at each time point by multivariate analysis of variance, F=18.936, P=0.000, P<0.05. This indicates that there is a statistically significant difference in serum IL-6 between the mentally disabled group and the non-mental disorder group. Serum IL-6 levels were compared at each time point in both groups by independent sample t-test. There was no significant difference in IL-6 between the two groups on the first day after injury (P>0.05). After injury, the difference between the two groups on the 3rd day, the 7th day, the 15th day, the 21st day, and the 30th day was statistically significant (P<0.05). IL-6 began to rise on the first day after injury, peaked on the 7th day after injury, and then began to decline, but it was still higher than the non-mental disorder group (P<0.05).

The levels of serum TNF-a in the patients with mental disorders and non-mental disorders are shown in Table 5 and Figure 6.

Multivariate analysis of variance was used to comprehensively compare the levels of serum cortisol at different time points, and F = 9.468, P =

0.0215, P < 0.05. It shows a significant difference in serum cortisol levels between the mentally ill and non-mental groups. Separate sample t-test was used to compare serum cortisol levels at each time point in both groups. It has a significant difference (P < 0.05). On the first day after the injury, cortisol gradually increased. On the third day after the injury, it reached its maximum value and then fell. However, it is still at a higher level than the non-mental disorder group (P<0.05).

Day	t	P
Day1	11.593	0.2934
Day3	40.461	< 0.001
Day7	64.253	< 0.001
Day15	22.972	0.0289
Day21	61.683	< 0.001
Day30	74.033	< 0.001

Table 5: Changes of serum Cortisol in two groups of patients.

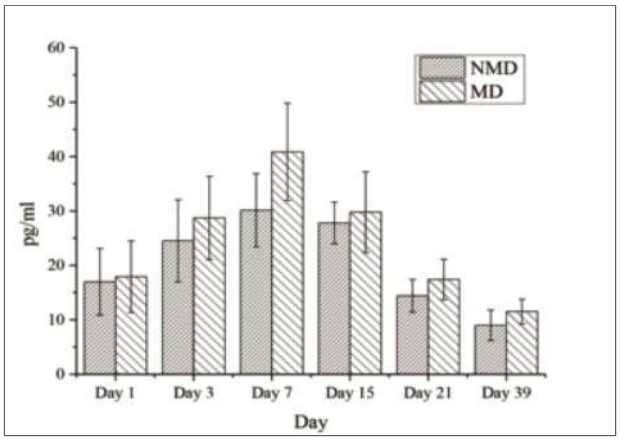

Fig. 6: Comparison of different phase points of serum Cortisol in two groups of patients.

Discussion

There were 275 patients with brain injury. Among them, 193 patients with mental disorders. This is very similar to the research done by other scholars[7, 8]. At present, the cause of mental disorders in patients after craniocerebral injury is unclear. Many studies have shown that brain injury factors as well as individual psychological factors and even social factors cause brain damage under the common effect[9]. In the case of acute craniocerebral injury, brain tissue edema, hypoxia, ischemia, and necrosis are caused, which changes the blood-brain barrier (BBB). This further caused biochemical and neurophysiological changes, which eventually led to mental disorders[10]. The occurrence of mental disorders is largely related to the nature, extent, and location of acute craniocerebral injury[11,12]. The severity of craniocerebral injury is related to the incidence of post-traumatic stress disorder to a certain extent. The degree of damage is proportional to the range. The more severe the damage, the easier it is to have a mental disorder after the injury.

Secondary damage after craniocerebral injury will also aggravate the condition after injury[13]. Mental disorders caused by head injury also show an increasing trend. In recent years, studies have shown that a key link in the pathophysiology of craniocerebral injury is inflammatory cytokines[14]. At the same time, the neuro-endocrine-immune network system is also the most important regulatory network of the body[15]. The pathophysiological process of acute craniocerebral injury is caused by the combination of cytokines and endocrine system disorders[16]. Especially in the acute phase of craniocerebral trauma, the body is under stress, over-activated inflammatory cytokines, and released a large number of cytokines such as IL-1β, IL-6 and TNF-a. Because the source of traumatic stress is too strong, it can rapidly activate the hypothalamus and the adrenal axis (HPA axis) and further aggravate the inflammatory response. At the same time, it will aggravate the secondary brain damage caused by craniocerebral injury, which will seriously damage the brain function, so that very serious complications occur[17]).

The reticular band of the adrenal cortex secretes cortisol, which is the terminal product of the HPA axis. Its secretion process is greatly affected by the circadian rhythm. The most intense period is 7:00 am.m-8:00 a.m., and the lowest time is 0:00 midnight. All patients in this study underwent a uniform collection of peripheral venous blood at 8:00 a.m. to avoid the effects of circadian rhythm on cortisol. Serum cortisol was dynamically monitored in both groups. It can be seen that cortisol began to increase gradually on the first day after injury and peaked on the third day after injury, which is consistent with other studies[18]. When the body suffers from a strong source of stress from craniocerebral injury, the HPA axis can be activated at a rapid rate, thereby increasing the secretion of cortisol. Craniocerebral injury can further cause a series of neuroendocrine symptoms such as ischemia, brain tissue edema, and hypoxia. Compared with the non-mental disorder group, the mental disorder group has higher serum cortisol levels, which can also prove the relationship between mental disorders and brain injury.

On the third day after injury, cortisol showed a downward trend. This suggests that the adrenal function may be disordered after stress. The trend of change is in full compliance with the findings of other scholars[19]. Changes in cortisol levels coincide with the time of onset of psychiatric symptoms in patients. Changes in cortisol levels can predict related indicators of psychiatric symptoms. Many related studies can demonstrate that cortisol changes have a certain relationship with the degree of brain injury[20]. In addition, studies of cortisol in mental disorders have found that cortisol levels can affect the occurrence of mental disorders[21], and the results of this study can also prove this.

Conclusion

In patients with acute craniocerebral injury, factors such as age, education level, degree of brain injury and location may affect the occurrence of mental disorders. Therefore, in clinical practice, doctors should assess the risk of mental disorders and intervene in high-risk patients. Serum IL-1β, IL-6, TNF-a, and cortisol were elevated in patients with early mental illness and acute brain injury, and there were differences at different time points after injury. Therefore, these can be used as identification of changes in the condition, and attention should be paid to the symptoms from the 3rd to the 7th day after the injury, which is important for clinical treatment.

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