SHORT COMMUNICATION

Prognostic significance of D-dimer, neuron-specific enolase, and lactate dehydrogenase changes in patients with severe traumatic brain injury: a logistic regression analysis

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Abstract

The retrospective study was conducted at Baoding No.1 Central Hospital, China, and comprised data from July 2021 to January 2023, and aimed at exploring the relationship of neuron-specific enolase, D-dimer and lactate dehydrogenase with prognosis in patients with serous traumatic brain injury. Data of 100 patients was categorised into favourable prognosis group A having 50(50%) patients and unfavourable prognosis group B having 50(50%) patients, and was compared with as many healthy controls in group C. Increase in neuron-specific enolase, D-dimer and lactate dehydrogenase concentrations was significantly elevated in groups A and B compared to group C ($p<0.05$), and in group B compared to group A ($p<0.05$).

Keywords: Severe traumatic brain injury, Neuron-specific enolase, D-dimer, Lactate dehydrogenase, Risk factors.

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Introduction

Neurosurgery clinics frequently encounter traumatic brain injury cases, and in most such cases the prognosis is generally poor.[1] Accurately assessing the condition and prognosis of people with severe traumatic brain injury is crucial for selecting appropriate clinical interventions. Neuron-specific enolase (NSE), D-dimer and lactate dehydrogenase (LDH) levels are widely used indicators for evaluating the neurological, coagulation and metabolic functions of such patients.[2] Nevertheless, there exists a dearth of research examining their efficacy in evaluating the prognostic accuracy of individuals having undergone serious traumatic brain damage.

The current study was planned to focus on patients with severe traumatic brain injury, and to analyse the alterations in NSE, D-dimer and LDH levels, as well as their relationship with patient prognosis.

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Methods and Results

The retrospective study was conducted at Baoding No.1 Central Hospital, China, and comprised data from July 2021 to January 2023. After approval from the institutional ethics review committee, serum D-dimer levels was used as a sample size estimation indicator with a differential design to calculate the sample size with the help of EpiInfo.[3] The sample size was inflated by 10% to cover for dropout cases. Data of 100 patients was categorised into favourable prognosis group A having 50(50%) patients, and unfavourable prognosis group B having 50(50%) patients. The data was compared with that of as many healthy controls in group C who were enrolled after taking written informed consent. Patient groups A and B were formed on the basis of Glasgow Outcome Scale (GOS) scores;[4] 1-3 in group A, and >3 in group B.

Those included in the groups A and B were patients aged 18 years or older, admitted within 24 hours of onset and diagnosed with definite traumatic brain injury confirmed by computed tomography (CT) scan, without malignant tumours, without previous neurological diseases. Patients who died within 24h, those with coagulation dysfunction or who had previously taken anticoagulant therapy, with diseases during pregnancy or lactation, and those with acute or chronic infectious or immune diseases were excluded.

Informed consent was obtained from all the participants or their legal guardians. All subjects had to undergo fasting venous blood testing for NSE levels using radioimmunoassay, LDH levels using enzyme-linked immunosorbent assay (ELISAY), and D-dimer levels using colloidal gold immunopermeation assay. All assay kits were procured from the market (Multi Sciences Biotech Co., Ltd., Hangzhou, China).

Data was analysed using SPSS 20. Data were expressed as mean ± standard deviation or frequencies and percentages, as appropriate. Data was subjected to t-test or chi-square test, as appropriate. Logistic regression analysis was used to examine the association between each index and the prognosis of patients. $P<0.05$ was considered statistically significant.

In group A, there were 31(62%) males and 19(38%) females

Table:-1 Comparative analysis of blood indices between patients with traumatic brain injury and healthy individuals.

Group	NSE/ng·mL^{-1}	LDH/U·L^{-1}	D-dimer/mg·L^{-1}
Severe traumatic brain injury group	18.47±4.51	83.19±10.38	18.08±2.19
Healthy group	5.83±1.02	31.27±7.46	3.71±0.65
t	26.694	35.080	60.503
p	0.000	0.000	0.000
Poor prognosis group	20.22±5.86	89.79±15.54	21.21±4.17
Good prognosis group	16.72±4.38	76.59±14.21	15.75±3.95
t	2.770	5.018	5.464
p	0.007	0.000	0.000

NSE: Neuron-specific enolase, LDH: Lactate dehydrogenase

Table:-2 Relationship of each blood index with prognostic quality in patients with severe traumatic brain injury.

Index	B	S.E.	χ2	p	OR	95%CI
NSE	0.654	0.198	10.910	0.001	1.923	1.305~2.835
LDH	0.731	0.313	5.454	0.020	2.077	1.125~3.836
D-dimer	0.689	0.274	6.323	0.012	1.992	1.164~3.408

NSE: Neuron-specific enolase, LDH: Lactate dehydrogenase, SE: Standard error, OR: Odds ratio, CI: Confidence interval.

having mean age 42.64±11.47 years (range: 31-75 years). In group B, there were 32(64%) males and 18(36%) females with mean age41.27±10.83 years (range: 31-75 years). In group C, there were 30(60%) males and 20(40%) females with mean age 40.98±12.18 years (range: 30-72 years) (p>0.05).

Increase in NSE, D-dimer and LDH concentrations was significantly elevated in groups A and B compared to group C (p<0.05), and in group B compared to group A (p<0.05) (Table 1). NSE, LDH and D-dimer levels in groups A and B were independent variables that influenced the prognosis (p<0.05) (Table 2).

Discussion

Traumatic brain injury is a serious condition having high fatality and disability rates. Assessing the severity of a patient's condition can lead to the development of targetted treatment plans, effectively improving the quality of prognosis and enhancing the clinical survival rate.[5]

Research has shown that NSE levels in the serum of patients with traumatic brain injury are elevated,[6,7] and there is a significant positive correlation between the D-dimer level and the condition of such patients.[8] In addition, LDH is a key enzyme that promotes neuronal metabolism in the human body. Usually, brain cell necrosis and oedema lead to unstable cell membranes and the release of various enzymes into the bloodstream.[9]

The current study indicated that the levels of NSE, LDH and D-dimer in the blood of patients with severe traumatic brain injury were significantly elevated. The levels of NSE, LDH and D-dimer in patients with poor prognosis were significantly higher than those in patients with good prognosis, indicating that NSE, LDH and D-dimer levels were independent risk factors affecting the prognosis of patients with severe traumatic brain injury.

The current study has limitations as data was collected from a single centre.

Conclusion

NSE, D-dimer and LDH levels in patients with severe traumatic brain injury were significantly elevated, indicating that they were independent factors affecting patient prognosis.

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JX: Design and preparation.
LZ: Data collection and analysis.
NG: Data acquisition, analysis, interpretation and drafting.