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Biochemical Changes in Cerebrospinal Fluid of Dogs Exposed to Trauma

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Abstract: This study was performed to determine the biochemical changes in cerebrospinal fluid (CSF) of the dogs exposed to trauma. Cerebrospinal fluids were collected from 12 nontraumatic and clinically healthy dogs and 12 traumatic dogs aged between 1 and 36 months for determination of AST, ALT and CK activities, Ca, Pi, Mg, glucose and creatinine levels. Compare to healthy dogs, no differences were determined in AST activity, Ca and Mg levels in traumatic dogs. However CK and ALT activities, glucose, Pi and creatinine levels increased. In conclusion, the biochemical changes in CSF of traumatic dogs may be of practical value for monitoring the prognosis and therapy.

Key words: Cerebrospinal fluid, biochemical parameters, dog, trauma

INTRODUCTION

Cerebrospinal fluid is a clear, watery liquid produced by Central Nervous System (CNS) that covers the entire surface of the brain and spinal cord penetrating the CNS parenchyma and it protects, supports and sustains the CNS (Feldman, 1989; Karagül *et al*., 2000).

Many substances that circulate in the blood may not enter the CSF and some chemicals in the brain and CSF will not diffuse into the general circulation. The selectivity is vital to the brain's function and is achieved by the blood-brain barrier (Feldman, 1989).

Changes in cerebral system may occur due to some factors which cause local or general degenerative disorders. Permeability increased in the case of such as intracranial hemorrhage, brain tumors, bacterial or viral meningitis, encephalitis, rupture and necrose. It has been accepted that analysis of CSF is important for diagnosis of CNS disorders (Feldman, 1989; Turgut, 1995). In this study, the biochemical changes in CSF of the dogs exposed to trauma were determined.

MATERIALS AND METHODS

In this study, 12 nontraumatic and clinically healthy dogs (control) and 12 traumatic dogs aged between 1 and 36 months were included into the study. In the physical inspection of the traumatic dogs suspected from CNS related lesions such as wounds at the head, paraplegia, incontinence, shock and agony due to the traffic accident, high rise syndrome, contusion and fighting were observed. Cranial and vertebral fracture and fissure were determined by direct radiography (35 mA, Poskom, XP40).

Cerebrospinal fluids were collected from extradural space in atlanto-occipital joint of all dogs. Fluids were centrifugated at 1300 g for 10 min. Clear CSFs were analysed by a spectrophotometer (Shimadzu UV Model 1208) using commercial kits for aspartate aminotransferase (AST), alanine aminotransferase (ALT) and creatine kinase (CK) activities, glucose, creatinine, calcium (Ca), inorganic phosphorus (Pi) and magnesium (Mg) levels (Biolabo, France).

Statistical analyses of data were performed by SPSS 13.0 version for Windows. Independent-Samples t-test was used to determine the differences. The differences were considered as significant when p values were less than 0.05. All data were expressed as means±SEMs.

RESULTS

No difference was determined between control and traumatic dogs for AST activity, Ca and Mg levels while

Table 1: Some biochemical parameters of cerebrospinal fluid in control and traumatic dogs

Parameters	Control group (n = 12)	Traumatic group (n = 12)	p	Reference values in dogs
AST (U L^{-1})	41.87±13.40	58.36±14.08	-	9-46 (4), 4.32-22.08 (5), 21.8-25.8 (8)
ALT (U L^{-1})	17.83±5.04	91.25±25.93	**	0.96-15.36 (5), 2-32 (6)
CK (U L^{-1})	21.53±9.58	157.55±40.97	**	23.5±0.19 (5), 24.60 (12)

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Table 1: Continue

Parameters	Control group (n = 12)	Traumatic group (n = 12)	p	Reference values in dogs
Glucose (mmol L^{-1})	2.18±0.47	5.33±0.43	***	2.44 (1), 4.11 (4), 3.61-6.55 (5)
Creatinine (μmol L^{-1})	18.56±4.42	76.02±5.30	***	-
Ca (mmol L^{-1})	1.37±0.04	1.60±0.12	-	1.64 (4), 1.28-1.85 (5), 1.37-1.62 (12), 1.76-1.90 (8)
Pi (mmol L^{-1})	0.60±0.04	1.45±0.32	*	1.00 (4), 20.91-1.12 (5), 0.36-1.26 (12), 0.76 (8)
Mg (mmol L^{-1})	0.91±0.06	1.12±0.10	-	1.27 (4), 1.06-1.57 (5), 1.28 (12)

-:non significant, *:$p<0.05$, **:$p<0.01$, ***:$p<0.001$

ALT ($p<0.01$) and CK activities as well as Pi ($p<0.05$), glucose and creatinine levels ($p<0.001$) were increased in CSF of the traumatic dogs (Table 1).

DISCUSSION

In this study, the CSF levels of the investigated parameters in control group were within the range of the reference values cited in the literatures (Ersoy and Bayşu, 1986; Feldman, 1989; Turgut, 1995; Tiftik, 1996; Nazifi *et al*., 1997; Karagül *et al*., 2000).

Various metabolic disorders (Patra *et al*., 1993), vitamin and mineral deficiencies (Aslan, 1991), bacterial (Nazifi *et al*., 1997), viral (Aslan, 1991) and mycotic (Lavely and Lisitz, 2005) diseases, brain anomalies (Aslan, 1991) and tumors (Scott-Moncrieff *et al*., 1991) result in intracranial pressure in CSF. Thus, the composition of CSF may be changed (Aslan *et al*., 1988).

In the present study, significant increases in ALT and CK activities in CSF of traumatic dogs were determined. It has been suggested that enzyme activities of CSF is the indicator of structural and functional disorders of CNS. Alanine amino transferase and CK activities of CSF may be elevated due to CNS degenerations and/or increases in the permeability of blood-brain barrier (Coles, 1986; Turgut, 1995). Increases in CK activity due to inflammation and trauma of CNS is accepted as an indicator of prognosis (Feldman, 1989; Turgut, 1995).

Glucose, Pi and creatinine levels of CSF were also increased in the traumatic dogs. Increases in glucose level may be either due to the increase of active transport of glucose from plasma to CSF (Turgut, 1995) or association with spinal cord compression (Coles, 1986). The levels of Pi in CSF averages about 60% of the serum concentration (Feldman, 1989). Creatinine is synthesized in liver, kidney and pancreas, then transported to muscle and brain (Karagül *et al*., 2000). Increases in creatinine and Pi levels in CSF may result from the increases in the permeability of blood-brain barrier due to trauma.

In conclusion, the biochemical changes in CSF of traumatic dogs may be of practical value for monitoring the prognosis and therapy.

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