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Reference Values and Age-Related Changes in Cerebrospinal Fluid and Blood Components in the Clinically Normal Male Dromedary Camel

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Abstract: There is a rare of information regarding the influence of age on cerebrospinal fluid (CSF) and blood components of the one-humped camels. To demonstrate these relationships, CSF and blood were collected from two age groups of male camels (1- >3 and 3-5 years). Most of CSF tested parameters (urea, creatinine, uric acid, total protein, non albumin protein) in large age group were showed a significant difference relative to small age camel group except glucose, albumin and electrolytes contents (Na, K and Cl). Age had no significant effect on the serum component except on the urea, creatinine and uric acid in the both age groups. These differences especially in CSF parameters between the two age groups may suggest that blood-brain barrier is not at the same stage of maturation or selective permeability.

Key words: cerebrospinal fluid, blood, age related, dromedary camel

Introduction

Extracellular fluid in the central nervous system (CNS) is composed of CSF, derived from the choroids plexus, and of interstitial fluid (ISF) in gray and white matter. In humans, investigation of CSF plays a significant role in diagnosis and management of neurological disease and pathologies involving the CSF itself (Weller, 1998).

In ruminant species CSF collection and analysis provides rapid and, in some situations, instant information to the veterinary clinician for investigating a disease problem in the living animals. Cerebrospinal fluid analysis is particularly useful with respect to confirming the presence of an inflammatory lesion involving the leptomeninges such as bacterial meningoencephalitis. When correctly performed under local anaesthesia, lumbosacral CSF collection in ruminants is a safe and there are no harmful sequelae. There are few indications for cisternal CSF collection in food animal practice (Scott, 1995).

There are many researches study the components of the CSF in many animals in relation to CNS disorders as in horses (Donaldson and Sweeney, 1998 and Sofaly *et al*., 2002), cattle (Tyler *et al*., 1993 and Braun *et al*., 2003), goats (Pusterla *et al*.,1997), cats (Rand *et al*., 1994), dogs (Hurt & Smith, 1997 and Bush *et al*., 2003) and piglets (Dallaire and DeRoth, 1981).

There is a paucity of information regarding the influence of age on the cerebrospinal fluid and blood components in animals with special reference to dromedary camels. There for the aim of our study is to through the light on the reference values of cerebrospinal fluid and serum components in relation to age change in male dromedary camels to offer further diagnosis and prognosis possibilities in the camel neurological disorders.

Material and Methods

Jugular venipuncture blood samples were collected from 20 apparently healthy one-humped male camels (*C. dromedarius*). The camels were allotted to two age groups (1- >3 and 3-5 years) according to the dentition formula given by Rabagliati (1924). After15 min of animals slaughtering or after complete bleeding, the neck of camel was separated from the body and carefully tilt the neck of the camel to receive the CSF to a wide mouth bottle at the slaughter edge of the neck. If the CSF sample was tinged with a blood the sample will be rejected.

The blood and CSF samples were collected in two tubes : one plane and the second tube contain sodium fluoride for glucose determination according to Coles (1986). The samples were centrifuged at 2500 g for 10 min. The supernatant fluids were stored at –20 ^{o}C until used for analysis.

Sodium and potassium concentration were assayed by digital flam analyzer, modle 2655-00 (Parmer Instrument Co., Chicago- Illinois-60648). Chloride, glucose, urea , creatinine, uric acid, total protein and albumin were determined colorimetrically using commercial kits (Bio-Merieux Laboratory Reagents and Products, France- catalog number: 61095, 61301, 61911, 61169, 61923, 61602, 61051, respectively). Each test were carried out duplicate then record the average.

Statistical analysis of the data was executed according to Snedecor and Cochran (1980). Means were assessed by Student t-test.

Results and Discussion

The results are recorded as mean ± standard error concentrations in both CSF and serum and are presented in Table 1 and 2.

There are a parallel significant picture (except proteins levels) in both CSF and serum components in the two age camels groups. There are a significant differences (P<0.05) in the levels of urea, creatinine and uric acid but no significant changes in the levels of glucose and electrolytes (Na, K and K) contents in both CSF and serum (Table 1 and 2).

The results in CSF clearly indicate a significant differences (P<0.05) in means of all parameters tested in the second age group (3-5 years) relative to 1st one (1->3 years) except glucose, albumin and electrolytes levels (Table 1).

Age had no significant effect on the serum components except on the urea, creatinine and uric acid (Table 2).

The age related changes in blood components in our study nearly agree with the recorded values in studies of Haroun *et al*. (1996) and Sarwar and Majeed (1997).

Table 1: Age-related changes in cerebrospinal fluid components in the clinically normal male dromedary camel (n=10)

		First age group (1->3 years)	Second age group (3-5 years)
Glucose	(mmol/1)	2.16±0.11	2.19±0.09
Urea	(mmol/1)	3.15±0.09	4.42±0.05*
Creatinine	(µmol/1)	83.10±4.42	72.49±2.65*
Uric acid	(mg/dl)	0.01±0.00	0.07±0.00*
	(µmol/1)	0.06±0.00	4.20±0.00*
Total protein	(mg/dl)	0.09±0.00	0.11±0.01*
	(mg/l)	0.90±0.00	1.10±0.10*
Albumin	(mg/dl)	0.02±0.00	0.02±0.00*
	(mg/l)	0.20±0.20	0.20±0.00
Non-albumin proteins	(mg/dl)	0.06±0.00	0.09±0.01*
	(mg/l)	0.60±0.00	0.90±0.10*
Sodium	(mmol/1)	153.00±2.79	155.60±2.91
Potassium	(mmol/1)	4.46±0.09	4.36±0.13
Chloride	(mmol/l)	84.60±0.69	84.00±0.67

Mean±SE *P<0.05

Table 2: Age-related changes in blood components in the clinically normal male dromedary camel (n=10)

		First age group (1->3 years)	Second age group (3.5 years)
Glucose	(mmol/l)	3.82±0.11	3.89±0.13
Urea	(mmol/l)	6.01±0.25	5.182±0.21*
Creatinine	(µmol/l)	68.95±2.65	83.10±2.65*
Uric acid	(mg/dl)	0.70±0.05	0.85±0.05*
	(µmol/l)	42.00±3.00	51.00±3.00*
Total protein	(g/l)	67.40±1.31	64.60±1.29
Albumin	(g/l)	38.00±0.75	36.64±1.29
Globulin	(g/l)	29.40±0.60	27.96±1.01
A/G ratio		1.29±0.01	1.33±0.37
Sodium	(Mmol/l)	146.80±3.29	155.00±5.77
Postassium	(mmol/l)	4.16±3.29	4.35±0.19
Chloride	(mmol/l)	85.00±0.67	85.40±0.64

The values of studied parameters in CSF is less than the values of serum parameters in both age camels groups except the uric acid and proteins contents of CSF are in a trace amounts. In contrary, the electrolytes (Na, K and Cl) of CSF and serum are nearly the same in the both age groups. These differences in components levels in both CSF and blood is due to blood-brain barrier permeability, which is not at the same stage of maturation between the two age groups. The same results in CSF were recorded on study of Dallaine and DeRoth (1981) in low birth weight piglets relative to normal birth weight ones.

Although CSF uric acid content is in a very trace amount, Stover *et al.* (1997) postulated that the CSF uric acid appear superior to lactate as a marker in reflecting glutamate-mediated excitotxicity (as viral meningitis) in neurological patients, which were increased 2-3 fold compared to control.

Electrolytes contents of CSF is important in respiratory drive. The relation between [Cl^-] and [HCo_3^- and Na^+] is very interested in maintenance of electrolyte balance. Therefore, Johnson *et al.* (1984) study the effect of furosemide (an inhibitor of sodium coupled chloride transport) on CSF electrolytes and suggesting sodium coupled chloride transport plays a role in regulation of CSF acid homeostasis.

In the present study, the sodium ratio in CSF: serum is nearly one either in small and large age camels groups. In contrary, Doiet *et al.* (1992) found that the movement Na and water, or both between the blood and CSF in acute hypernateraemia is greater in juvenile rat relative to adult one (i.e. the osmoreceptors in juvenile rat are more sensitive than those in adult rat or there are age-differences in osmoreception).

In conclusion, these differences especially in CSF components between the two age groups (1->3 and 3-5 years) may suggest that blood-brain barrier is not at the same stage of maturation or selective permeability to the blood constituents in small and large age dromedary camels.

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