

## REFERENCE VALUES AND AGE-RELATED CHANGES IN CEREBROSPINAL FLUID AND BLOOD COMPONENTS IN THE CLINICALLY NORMAL MALE DROMEDARY CAMEL

\*O. A., AL-SAGAIR ; \*\* S. I. FATHALLA ;and \*\*\*, H. A.ABDEL-RAHMAN

\*Dept. Med. Microbiol., College of Sci., Al-Qassem Univ., Buriedah, , KSA.

\*\* Dept. Physiol., Fac. Vet. Med., (El-Sadat), Monofia Univ. Egypt

\*\*\* Dept. Physiol., Fac. Vet. Med. (Moshtohor), Zagazig University (Benha), Egypt

**Received:** 13.3.2005.

**Accepted:** 20.3.2005.

### SUMMARY

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 for glucose, albumin and electrolytes contents (Na, K and Cl). Age had no significant effect on the serum component except for 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.

**Keywords:** 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 on the components of the CSF in many animals in relation to CNS disorders as in horses (Donaldson & 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 & 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 the present 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) ac-

ording to the dentition formula given by Rabagliati (1924). After 15 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 plain 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 °C until used for analysis.

Sodium and potassium concentration were assayed by digital flame analyzer, model 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.

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

		First age group (1-<3years)	Second age group (3-5years)
Glucose	(mmol/l)	2.16 ± 0.11	2.19 ± 0.09
Urea	(mmol/l)	3.15 ± 0.09	4.42 ± 0.05*
Creatinine	(µmol/l)	83.10 ± 4.42	72.49 ± 2.65*
Uric acid	(mg/dl)	0.01 ± 0.00	0.07 ± 0.00*
	(µmol/l)	0.60 ± 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/l)	153.00 ± 2.79	155.60 ± 2.91
Potassium	(mmol/l)	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 (II):** Age-related changes in blood components in the clinically normal male dromedary camel (n=10).

		First age group (1-<3years)	Second age group (3-5years)
Glucose	(mmol/l)	3.82 ± 0.11	3.89 ± 50.13
Urea	(mmol/l)	6.01 ± 0.25	5.18 ± 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	(mg/dl)	67.40 ± 1.31	64.60 ± 1.29
Albumin	(mg/dl)	38.00 ± 0.75	36.64 ± 0.65
Globulin	(g/l)	29.40 ± 0.60	27.96 ± 1.01
A/G ratio	(g/l)	1.29 ± 0.01	1.33 ± 0.37
Sodium	(mmol/l)	146.80 ± 3.29	155.00 ± 5.77
Potassium	(mmol/l)	4.16 ± 0.15	4.35 ± 0.19
Chloride	(mmol/l)	85.00 ± 0.67	85.40 ± 0.64

Mean ± SE

\*P<0.05

## RESULTS

The results are recorded as mean  $\pm$  standard error concentrations in both CSF and serum. The obtained data are presented in Table I and II.

There is 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 were observed in the levels of glucose and electrolytes (Na, K and K) contents in both CSF and serum (Table I and II).

The results of 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 the 1<sup>st</sup> one (1->3 years) except for glucose, albumin and electrolytes levels (Table I).

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

## DISCUSSION

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

The values of studied parameters in CSF were lower than the corresponding values obtained from serum analysis in both age groups except for the uric acid and proteins contents of the CSF which were significantly lower. The electrolyte contents (Na, K and Cl) of both CSF and serum in the two age groups were not differ significantly. The recorded differences in components levels between CSF and blood might be due to blood-brain barrier permeability, which might not be at the same stage of maturation between the two age groups. The same results in CSF were recorded by of Dallaine and DeRoth (1981) in low birth weight piglets relative to normal birth weight ones.

Although CSF uric acid content was found to be 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 excitotoxicity (as viral meningitis) in neurological patients, which were increased 2-3 fold compared to control.

The relation between electrolyte contents of CSF ( $\text{Cl}^-$ ,  $\text{HCO}_3^-$ , and  $\text{Na}^+$ ) is very important in maintenance of electrolyte balance in respiratory drive. Therefore, Johnson et al. (1984) studied the effect of furosemide (an inhibitor of sodium coupled chloride transport) on CSF electrolytes and suggested that sodium coupled chloride transport played a role in regulation of CSF acid homeostasis.

In the present study, the sodium ratio in CSF/serum was nearly the same either in small or large age camels groups. In contrary, Doiet et al. (1992) found that the movement of Na and water, between the blood and CSF in acute hypernatraemia was greater in juvenile rats relative to adult ones (i.e. the osmoreceptors in juvenile rats were more sensitive than those in adult ones or there were 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.

## REFERENCES

- A. Dallaire and L. DeRoth, 1981. Cerebrospinal fluid composition in newborn piglets. *Can. J. Comp. Med.*, 45(2): 205-206.
- A. E. Hurtt and M.O. Smith, 1997. Effects of iatrogenic blood contamination on results of cerebrospinal fluid analysis in clinically normal dogs and dogs with neurological disease. *J. Am. Vet. Med. Assoc.*, 211(7): 866-867.
- A. Sarwar, and M. A. Majeed, 1997. Interrelationships between 30 parameters of blood in normal one-humped camel in summer. *J. Camel Prac. Res.*, 4(1): 35-39.
- C. D. Sofaly, S. M. Reed, J. C. Gordon, J. P. Dubey, M. J. Oglebee, C. J. Njoku, D. L. Grover and W. J. Saville, 2002. Experimental induction of equine protozoan of equine myeloencephalitis (EPM) in the horses: effect of *Sarcocystis neurona* sporocyst inoculation dose on the development of clinical neurological disease. *Parasitol.*, 88(6): 1164-1170.
- Coles E. H., *Veterinary Clinical Pathology*, 4th ed. Saunders Company, Philadelphia, London, Toronto, 1986.
- D. C. Johnson, H. M. Frankel and H. Kazemi, 1984. Effect of furosemide on cerebrospinal fluid composition. *Respir. Physiol.*, 56(3): 301-308.
- E. M. Haroun, O. M. Mahmoud, M. Magzoub, Y. Abdel-Hamid and O. H. Omar, 1996. The haematological and biochemical effects of the gastrointestinal nematodes prevalent in camels (*Camelus dromedarius*) in central Saudi Arabia. *Vet. Res. Communic.*, 20: 255-264
- J. F. Stover, K. Loitzsch and O. K. Kempfski, 1997. Cerebrospinal fluid hypoxanthine, xanthine and uric acid levels may reflect glutamate-mediated excitotoxicity in different neurological diseases. *Neuro. Sci. Lett.*, 238(1-2): 25-28.
- J. S. Rand, D. Percy and R. Jacobs, 1994. Clinical, cerebrospinal fluid, and histological data from twenty-seven cats with primary inflammatory disease of central nervous system. *Can. Vet. J.*, 35(2): 103-110.
- J. W. Tyler, E. G. Welles, D. C. Sorjonen, J. S. Spano, J. T. Gaslin and H. Spears, 1993. Cerebrospinal fluid composition of cattle with endotoxin-induced mastitis treated with isotonic (0.9%) or hypertonic (7.5%) sodium chloride. *J. Vet. Intern. med.*, 7(2): 91-94.
- M. T. Donaldson and C. R. Sweeney, 1998. Herpesvirus myeloencephalopathy in horses: 11 cases (1982-1996). *J. Am. Vet. Med. Assoc.*, 213(5): 671-675.
- N. Pusterla, P. Capfazi, and U. Braun, 1997. Cerebrospinal nematodiasis in seven goats. *Schweiz Arch Tierheilkd.*, 139(6): 282-287.

- P. R. Scott, 1995. The collection and analysis of cerebrospinal fluid as an aid to diagnosis in ruminant neurological disease. *Br. Vet. J.*, 151(6): 603-614.
- Rabagliati, D. S., 1924. *The Dentition of the Camel*. The Government Publications Office, Ministry of Finance, Cairo, Egypt.
- R. O. Weller, 1998. Pathology of cerebrospinal fluid and interstitial fluid of the CNS: Significance for Alzheimer disease, prion disorders and multiple sclerosis. *J. Neuro-pathol. Exp. Neurol.*, 57(10): 885-894.
- Snedecor, G. W. and Cochran, W. G., *Statistical Methods*, 6th ed. Oxford, New Delhi, 1980.
- U. Braun, C. Gerspach, F. Salis, K. Feige, 2003. Clinical findings in four cattle with abscesses in the cervical vertebrae. *Schweiz Arch Tierheilkd.*, 145(3): 124-128.
- W. W. Bush, J. L. Throop, P. M. McManus, A. S. Kapatkin, C. H. Vite and T. J. Van Winkle, 2003. Intravascular lymphoma involving the central and peripheral nervous system in a dog. *J. Am. Anim. Hosp. Assoc.*, 39(1): 90-96.
- Y. Doi, H. Nose and T. Morimoto, 1992. Changes in Na concentration in cerebrospinal fluid during acute hypernatremia and their effect on drinking in juvenile rats. *Physiol Behav.*, 52(3): 499-504.