Vol 13 No 2, p 145-147

PHYSICAL, BIOCHEMICAL AND CYTOLOGICAL ANALYSIS OF SYNOVIAL FLUID OF RADIOCARPAL JOINT OF CLINICALLY NORMAL YOUNG CAMELS *(Camelus dromedarius)*

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ABSTRACT

Present study was carried out to determine the protein and cellular composition of synovial fluid in clinically normal radiocarpal joints in young camels *(Camelus dromedarius)*. Bilateral arthrocentesis of the radiocarpal joints was performed and synovial fluid's total nucleated cell counts, absolute and percentages of polymorphnuclear leukocytes, lymphocytes, monocytes/macrophages and total protein concentration were determined. The mean ± SD and range of total nucleated cell counts were 80 to 2300 cells/µl (600 ± 500 cells/µl). Mononuclear leukocytes were the predominant cell type with lymphocytes, composing 0-90% (60 ± 25 cells/µl). The total protein concentration ranged from 1 to 3 g/dl (2 ± 1 g/dl). Statistically, there were no significant differences between the synovial fluid cellular and protein contents of right and left radiocarpal joints. These values are helpful in determining the health status of the radiocarpal joints in clinically lame animals.

Key words: Camel, differential leukocytes count, protein, radiocarpal joint, synovial fluid, total nucleated cell counts

In the United Arab Emirates, there are more than 100,000 racing camels (Wilson *et al*, 1990). Similar to other animals, the musculoskeletal system, especially joints of young camels are susceptible to a variety of infectious and noninfectious or traumatic disorders that may affect their future racing career.

Synovial fluid is a modified transudate, formed primarily through active secretion by the synovial membrane lining joints and tendon sheaths (Duncan *et al*, 1994). According to its cellular and protein contents, synovial fluids can be classified into inflammatory, noninflammatory, septic, purulent and haemorrhagic types (Duncan *et al*, 1994).

Values of normal synovial fluid components were reported for horses (Rose and Frauenfelder, 1982), cattle (Van Pelt and Conner, 1963; Krishnamurthy and Tyagi, 1978 and Rohde *et al*, 2000), llama and alpaca (Waguespack *et al*, 2002), elbow joint of adult camels (Nazifi *et al*, 1998), tarsal and fetlock joints of young camels (Al-Rukibat *et al*, 2006 and Bani Ismail and Al-Rukibat, 2006).

The specific data routinely included in synovial fluid analysis are volume, colour, turbidity, total nucleated cell counts (TNCC), percentage of nucleated cells including polymorphnuclear cells (PMNS), lymphocytes, monocytes/macrophages, eosinophils, and basophils, total protein (TP) concentration, viscosity and specific gravity (Duncan *et al*, 1994). Cytologically, mononuclear cells predominate in normal synovial fluids in large and small animals (Duncan *et al*, 1994). PMNS are rarely present and eosinophils and basophils are not expected (Duncan *et al*, 1994).

In camels, there is little information in the literature regarding synovial fluid analysis of different joints of various age groups of camels. The purpose of this study was to determine the varions physical, bichemical and cytological parameters of clinically and radiographically normal radiocarpal joints of young camels.

Materials and Methods

Collection of the synovial fluid samples: Synovial fluid samples were collected from both radiocarpal joints of 30, clinically normal young camels *(Camelus dromedarius)*, age between 9 and 12

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months. Arthrocentesis of the radiocarpal joints was performed asepticaly immediately after camels were slaughtered using 18-gauge, 1.5 inch needle which was inserted in the dorsal pouch of the radiocarpal joint. At least, 3 millilitres of synovial fluid samples were collected.

Gross and radiographic evaluation of joints: The joints were examined grossly to exclude joint abnormalities. Lateral and dorsomedial radiographic projections of all radiocarpal joints were obtained.

Synovial fluid analysis: The volume, colour and turbidity of the collected fluid were determined by visual inspection at the time of sample collection. The TNCC in the synovial fluid were carried out using a standard haemocytometer. Total protein concentration in synovial fluid samples was determined using regular refractometer.

Slide preparation and cytology: Films were prepared directly from the sample as well as from resuspended sediment. All films were stained with Wright's stain. Films were examined for cell population and cellular morphology. A 100-cell differential leukocyte count was performed.

Statistical analysis : Data were expressed in mean ± SD and ranges. Student's t-test was used to contrast the effect of limb (left vs right) on each variable. Statistical analyses were performed using Graphpad Prism for windows (Graphpad, San Diego, CA). The difference was considered significant at values of $P< 0.05$.

Results

Approximately 3 ml of synovial fluid were obtained easily from 60 radiocarpal joints. Eight samples were bloody and 4 samples were slightly turbid in appearance and were excluded from the analysis. The remainder of the samples (48) was pale to yellow in colour, clear and free of flocculent materials. Table 1 shows the mean ± SD and ranges of TNCC, absolute and percentages of PMNS leukocytes, lymphocytes, monocytes/macrophages and TP concentrations. Mononuclear cells were the predominant cell type in all samples. When the values of TNCC, absolute and percentages of PMNS, lymphocytes, monocytes/macrophages and TP concentrations were compared, no significant differences were found between the left and right radiocarpal joints (Table 2).

Discussion

Results of this study indicate that the synovial fluid TNCC in the radiocarpal joint of young camels are higher than those reported in cattle (Van Pelt and Conner, 1963; Krishnamurthy and Tyagi, 1978 and Rohde *et al*, 2000), and horses (Rose and Frauenfelder, 1982), and elbow joints of adult camels (Nazifi *et al*, 1998). When compared to other New World camelids, the TNCC were similar (Waguespack *et al*, 2002).

Similar to other species, three nucleated cell types were seen in synovial fluid of the young camel radiocarpal joint which include PMNS, lymphocytes, and monocytes/macrophages. Eosinophils and basophils were not observed in the fluid in this study. Similar to other animals, mononuclear cells were the predominant cell type in the radiocarpal joint synovial fluid. The mean values of PMNS percentages in the radiocarpal joints of young camels in this study agreed well with the reported values in llama/alpaca (Waguespack *et al*, 2002), horse (Rose and

Table 1. Cellular constituents and protein concentration in the radiocarpal joint synovial fluid in clinically normal camels (n=48).

Variables	Right and Left Radiocarpal Joints	
	Mean ± SD	Range
TNCC (cells/µl)	600 ± 500	80-2300
PMNS		
Percentage	4 ± 5	0-15
Absolute (cells/µl)	24 ± 49	0-250
Lymphocytes		
Percentage	60 ± 25	0-90
Absolute (cells/µl)	310 ± 276	0-1380
Mono/Macrophages		
Percentage	36 ± 23	7-88
Absolute (cells/µl)	222 ± 265	14-1000
Proteins (g/dl)	2 ± 1	1-3

Table 2. Absolute numbers of PMNS, lymphocytes and monocytes/macrophages of the radiocarpal joint synovial fluid from clinically normal camels (n=48).

Variables	Right		Left	
	Mean±SD	Range	Mean±SD	Range
TNCC (cells/µl)	600±580	80-2300	640±522	80-1920
PMNS				
Percentage	4±5	0-15	3±5	0-13
Absolute (cells/µl)	31±60	0-250	27±60	0-250
Lymphocytes				
Percentage	60±22	6-90	58±27	0-90
Absolute (cells/µl)	310±300	45-1380	298±248	0-840
Mono/Macrophages				
Percentage	32±20	7-80	39±26	7-88
Absolute (cells/µl)	187±230	14.3-920	251±290	34-1006
Total protein (g/dl)	2±1	2-3	2±1	1-3

Frauenfelder, 1982), but significantly lower than values reported in the elbow joints of adult camels (Nazifi *et al*, 1998).

Total protein concentration in synovial fluid of the young camels radiocarpal joint are higher than the values reported in cattle (Van Pelt and Conner, 1963; Krishnamurthy and Tyagi, 1978 and Rohde *et al*, 2000), and horses (Rose and Frauenfelder, 1982) but similar to those values reported in llama/alpacas (Waguespack *et al*, 2002). In agreement with other species, no significant differences were observed between left and right radiocarpal joints regarding the TNCC, differential leukocyte counts and TP concentrations.

In this study a data base was established that could be used as a reference range values for the synovial fluid of the radiocarpal joint in 9 to 12 months old one-humped camels. This information could be valuable in determining the health status of this joint as gross changes, radiographic evidence and culture results may appear late in the pathologic process or are unrewarding.

Acknowledgements

The authors thank the Deanship of Research at Jordan University of Science and Technology for sponsoring this work.

References

Al-Rukibat RK, Bani Ismail Z and Al-Zghoul MB (2006). Cytologic analysis of synovial fluid in clinically normal tarsal joints of young camels. Veterinary Clinical Pathology (In Press).

Bani Ismail Z and Al-Rukibat R (2006). Synovial fluid cell counts and total protein concentration in clinically normal fetlock Joints of young dromedarian Camels. Journal of Veterinary Medicine A (In Press).

Duncan JR, Prasse KW and Mahaffey EA (1994). Cytology. In: Veterinary Laboratory Medicine: Clinical Pathology. Eds., Duncan, JR, Prasse, KW and Mahaffey EA. 4th Edn. Iowa State University Press. Iowa. pp 204-228.

Krishnamurthy D and Tyagi RP (1978). Viscosity of normal bovine and camel synovial fluid. The Indian Veterinary Journal 55:986-8.

Nazifi S, Rezakhani A and Gheisari HR (1998). Physical, biochemical and cytologic properties of blood and synovial fluid in clinically normal adult camel *(Camelus dromedarius)*. Journal of Veterinary Medicine A 45:155-160.

Rohde C, Anderson DE, Desrochers A, St-Jean G, Hull BL and Rings DM (2000). Synovial fluid analysis in cattle: a review of 130 cases. Veterinary Surgery 29:341-346.

Rose RJ and Frauenfelder HC (1982). Arthrocentesis in the horse. Equine Veterinary Journal 14:173-177.

Van Pelt RW and Conner GH (1963). Synovial fluid from the normal bovine tarsus. I. Cellular constituents, volume, and gross appearance. American Journal of Veterinary Research 24:537-544.

Waguespack RW, Belknap EB, Spano JS, Wenzel JG, Pugh D (2002). Analysis of synovial fluid from clinically normal alpaca and llamas. American Journal of Veterinary Research 63:576-578.