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PERCUTANEOUS ULTRASOUND-GUIDED PORTOCENTESIS IN CAMELS (*Camelus dromedarius*)

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ABSTRACT

This report describes the adaptation of ultrasound-guided portocentesis technique in 15 adult healthy camels (*Camelus dromedarius*) for portal vein blood collection. A second objective of the study was to compare haematological and biochemical constituents between portal vein blood (PB) and jugular vein blood (JB). The liver could be visualised in an area between the 11th to 5th intercostal space (ICS) on the right side. The portal vein (PV) was visible in the 11th, 10th and 9th ICS. The centesis of the portal vein was successfully performed in all animals. The PV was round in cross sectional view; additionally, the PV was characterised by the typical stellate ramification at the portal fissure and therefore, it could be differentiated from other hepatic veins in this region. Compared to the wall of the PV, the walls of the hepatic vein appeared less echogenic. The majority of the measured haematological and biochemical parameters differed significantly between PB and JB.

Key words: Camel, dromedary, portal blood, portocentesis, ultrasonography

Hepatic portal blood (PB) has been the subject of a variety of physiological and/or nutritional studies in cattle (Huntington, 1990; Huntington *et al,* 1990; Reynolds *et al,* 1994; Ortigues *et al,* 1996; Braun *et al,* 2000; 2003; Oikawa *et al,* 2011). In most of them portocentesis was performed via catheterisation of the vein during laparotomy. However, this procedure is invasive, stressful for the animal, time-consuming, technically difficult, and results frequently in post-surgical complications e.g. peritonitis and adhesions (Olesen *et al,* 1989). It seems that the first report on ultrasound-guided percutaneous portocentesis in cattle has been published by Lechtenberg *et al* (1989). Later, the technique has been modified by Braun *et al* (2000; 2003) and Mohamed *et al* (2003c), and is currently considered an easy to perform and low-risk procedure for collection of PB. In contrast to our best knowledge, this technique has not been developed for camels. The first objective of the present study was to adapt the method of ultrasound-guided portocentesis to obtain blood from the portal vein for camels. The secondary aim was to compare haematological and biochemical parameters between PB and jugular blood (JB) in healthy dromedary camels.

Materials and Methods

A convenience sample of 15 non-pregnant and non-lactating female camels (*Camelus dromedarius*) (age: 7.9±2.9 years; weight 517±77 kg) was used in the study. The animals underwent a complete physical examination (Köhler-Rollefson *et al,* 2001); based on a 1 to 5 scale, the body condition score (BCS) of the animals was determined (Sghiri and Driancourt, 1999). The camels were fed only hay; water was provided *ad libitum.*

The portocentesis was performed in the morning (9 a.m. - 12.00 a.m.), 2-3 hr after feeding. Animals were mildly sedated using xylazine (0.07 mg/kg BW, intravenous, Bomazine® 10%, Bomac Laboratories Ltd, New Zealand) and were secured in a sitting position. The right side of the thorax and abdomen was clipped and shaved. Ultrasonographic examination was performed using a 3.5 MHz sector transducer (SSD-500, Aloka, Tokyo, Japan). After the application of transmission gel, the liver was examined beginning at the right paralumbar fossa caudal to the last rib and moving stepwise cranially to the 5th intercostal space (ICS). Each ICS was examined from dorsal to ventral. Initially, the hepatic texture, hepatic and portal veins, visceral and diaphragmatic surface were examined. Visualising the PV a site for portocentesis was identified and the region was infiltrated with 10 ml of 2% lidocaine (Norbrook Laboratories Limited, UK). A stab incision was made through the skin with the tip of a scalpel blade. A

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spinal needle (14G × 200 mm spinal needle, Kurita Co., Ltd, Tokyo, Japan) was advanced through the skin incision into the hepatic parenchyma towards the PV using an ultrasound-guided, free-hand technique. To reach the portal vein the needle was directed parallel to the horizontal plane of the ultrasound probe and between 20-40° to the vertical plane of the transducer. The needle appeared on the ultrasound image as a fine echogenic line (Fig 1). When the tip had entered the portal vein, the stylet was removed and blood was withdrawn using a 10 ml plastic syringe.

Haematological and biochemical analyses

Two venous blood samples were simultaneously obtained from the portal and jugular veins from each camel. The blood for haematological analyses were sampled into EDTA tubes and analysed within 30 minutes using an automatic analyser (Vet Scan HM5, ABAXIS, Hungary). The parameters, white blood cell count, neutrophils, lymphocytes, monocytes, red blood cell count, thrombocytes, haematocrit (packed cell volume, PCV), MCV, MCH and MCHC were measured or calculated. The samples for biochemical parameters were obtained in plain tubes and centrifuged immediately. The serum was harvested and stored at -21°C until analysed. An automated biochemical analyser (A15, BioSystems, Spain) was used to measure the biochemical parameters: total protein, albumin, globulin, albumin/globulin ratio, glucose, total bilirubin, blood urea nitrogen, creatinine, cholesterol, triglycerides, high density lipoproteins (HDLP), very low density lipoproteins (VLDL), calcium, magnesium, sodium, potassium, chloride, and the enzyme activities (AST, GGT, AP, CK) in serum from JV and PV blood samples.

Statistical analysis

Normal distribution of the data was tested using the Kolmogorov Smirnov test. As the majority of variables were not normally distributed, data are presented as medians and quartiles. Haematological and biochemical parameters were compared between blood sample obtained from PV and JV, using the Wilcoxon test. The level of significance was set at $P < 0.05$. A statistical program (SPSS version 19.0, IBM, New York) has been used for the analyses.

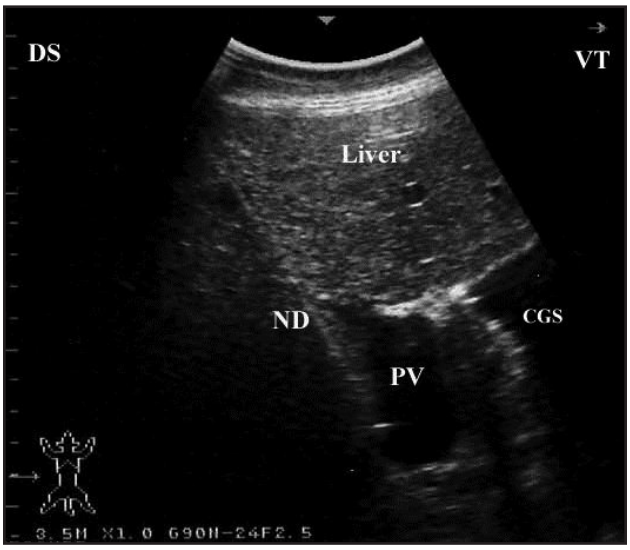

Fig 1. Portocentesis in a healthy camel. The needle (ND) appears on the screen as a sharp bright line. The image was taken in the right 10th intercostal space using a 3.5 MHz convex transducer. PV = portal vein; CGS = caudal glandular sacs. DS = dorsal; VT = ventral

Table 1. Haematological parameters (Median, 1st Quartile, 3rd Quartile) measured in blood samples which were simultaneously obtained from the portal vein (ultrasound-guided portocentesis) and jugular vein in adult female dromedary camels (n=15), significant difference between the samples are indicated by p values < 0.05.

Parameter	Portal vein blood			Jugular vein blood			Difference (p)
	Median	1st Quartile	3rd Quartile	Median	1st Quartile	3rd Quartile	
White Blood Cells ($\times10^9$/L)	15.21	12.36	25.51	18.93	18.24	22.61	0.005
Neutrophils ($\times10^9$/L)	7.55	6.03	14.04	9.47	8.59	14.23	0.069
Lymphocytes ($\times10^9$/L)	5.99	4.96	7.20	7.92	4.81	9.96	0.009
Monocytes ($\times10^9$/L)	0.49	0.41	0.6	0.88	0.62	1.16	0.008
Red Blood Cells ($\times10^{12}$/L)	8.87	7.82	9.42	9.39	8.23	10.90	0.001
Haemoglobin (g/L)	140.0	115.0	155.0	160.0	114.0	167.0	0.011
Haematocrit (PCV, %)	22.85	20.17	24.52	24.52	21.29	27,30	0.002
MCV (fl)	26.50	26.00	27.00	26.00	26.00	27.00	0.016
MCH (pg)	16.30	15.00	17.50	15.40	15.00	17.80	0.593
MCHC (g/dL)	61.40	56.00	65.70	58.60	54.60	67.55	0.432
Thrombocytes ($\times10^9$/L)	97.00	68.00	123.00	160.00	82.00	203.00	0.003

Results

No abnormalities were found during physical examination and none of the camels had any history of hepatobiliary disease. The BCS in the camels was 3.6±0.4. The liver could be ultrasonographically visualised between the 11th to 5th ICS. Tharwat (2012) also performed ultrasonography of liver and kidneys. The PV could be differentiated from the hepatic veins in the area of portal fissure, because the PV is characterised by stellate ramification in this region. The PV was visible in the 11th, 10th and 9th ICS and it was round shaped when seen in transverse section with a moderate echogenic wall. Identification of the PV was easily possible in all camels of the present study, the portocentesis was performed in 9 camels in the 9th intercostal space and in 6 camels in the 10th intercostal space. All camels tolerated the procedure well, no adverse effects were observed afterwards.

The haematological and biochemical parameters in portal vein and jugular vein blood are shown in tables 1 and 2. A number of parameters were significantly higher in JB (Tables 1 and 2). However, MCV, MCH, MCHC, glucose, AST, TBIL, BUN, HDLP and sodium were higher in PB. The differences between PB and JB were statistically insignificant only for neutrophils, MCH, MCHC, AST, GGT, TBIL, BUN, triglycerides, VLDL and sodium.

Discussion

Percutaneous ultrasound-guided portocentesis was used to obtain portal vein blood samples to measure haematological and biochemical parameters in portal vein blood in cows (Braun *et al,* 2000; Mohamed *et al,* 2002a), bile acid extraction rate in the liver in cows with high-fat diet (Mohamed *et al,* 2002b), bile acid extraction rate in the liver of cows with fasting-induced hepatic lipidosis (Mohamed *et al,* 2004a), and changes of very low-density lipoprotein concentration in hepatic blood from cows with fasting-induced hepatic lipidosis (Oikawa *et al,* 2011). These experiments were conducted to study nutrition and physiology in cows as blood obtained from portal circulation allows the measurement of nutrients that have been absorbed from the gastrointestinal tract

Table 2. Biochemical parameters measured in blood samples which were simultaneously obtained from the portal vein (ultrasound-guided portocentesis) and jugular vein in adult female dromedary camels (n=15), Significant difference between the samples are indicated by p values < 0.05.

Parameter	Portal vein blood			Jugular vein blood			Difference (p)
	Median	1st Quartile	3rd Quartile	Median	1st Quartile	3rd Quartile	
Total protein (g/L)	62.00	62.00	63.00	68.00	66.00	69.00	0.001
Albumin (g/L)	39.00	38.00	40.00	41.00	40.00	42.00	0.002
Globulin (g/L)	25.00	24.00	25.00	28.00	26.00	28.00	0.000
Albumin/Globulin Ratio	1.60	1.50	1.70	1.50	1.45	1.54	0.001
Glucose (mmol/L)	8.10	7.30	8.50	7.00	6.40	7.40	0.000
Bilirubin (µmol/L)	4.10	3.90	4.40	3.90	3.90	4.40	0.916
Blood urea nitrogen (mmol/L)	17.00	16.00	19.00	16.00	15.00	20.00	0.316
Creatinine (µmol/L)	69.00	64.00	72.00	72.00	69.00	80.00	0.001
Cholesterol (mmol/L)	1.09	0.94	1.14	1.33	1.17	1.40	0.000
Triglycerides (mmol/L)	0.67	0.63	0.74	0.72	0.69	0.75	0.059
HDLP (mmol/L)	0.20	0.19	0.23	0.18	0.16	0.21	0.002
VLDL (mmol/L)	0.31	0.29	0.36	0.34	0.31	0.36	0.204
AST (U/L)	66.00	60.00	74.50	64.00	55.00	71.00	0.104
GGT (U/L)	6.25	6.00	6.50	6.00	5.40	7.30	0.756
AP (U/L)	5.00	5.00	5.20	9.00	7.50	11.00	0.001
CK (U/L)	74.00	59.00	86.00	106.0	95.00	108.8	0.002
Calcium (mmol/L)	2.60	2.53	2.73	2.70	2.68	2.75	0.006
Magnesium (mmol/L)	0.52	0.49	0.55	0.75	0.70	1.05	0.001
Sodium (mmol/L)	164.0	162.0	166.0	162.0	161.5	163.0	0.053
Potassium (mmol/L)	4.20	3.80	4.70	5.20	4.55	5.75	0.000
Chloride(mmol/L)	78.00	75.00	80.00	88.00	86.50	90.00	0.000

prior to entry into the general circulation. Therefores access to the portal vein blood is considered a method to monitor hepatic metabolism and to quantify liver and intestinal function (Mohamed *et al,* 2003c). The results of the present study in camels corroborate previous findings in cattle (Braun *et al,* 2000; Mohamed *et al,* 2002a&b, 2003c, and 2004a), which showed that ultrasound-guided percutaneous portocentesis is easy to perform, low-risk procedure. This technique can also be applied to other organs which has been previously reported for ultrasound-guided hepatic and renal biopsy in camels (Mohamed *et al,* 2012). In a study using 21 cows (Braun *et al,* 2000) similar results have been described showing that the majority of measured haematological and biochemical parameters differed significantly between bood samples from the jugular and portal vein.

Conclusion

This study confirms that real-time ultrasound-guided portocentesis is a safe and accurate method can be performed in camels.

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References

Braun U, Koller-Wild K and Bettschart-Wolfensberger R (2000). Ultrasound-guided percutaneous portocentesis in 21 cows. Veterinary Record 14:623-626.

Braun U, Camenzind D and Ossent P (2003). Ultrasound-guided catheterisation of the portal vein in 11 cows using the seldinger technique. Journal of Veterinary Medicine Series A 50:1-7.

Huntington GB (1990). Energy metabolism in the digestive tract and liver of cattle: influence of physiological state and nutrition. Reproduction, Nutrition, Development 30:35-47.

Huntington GB, Eisemann JH and Whitt JM (1990). Portal blood flow in beef steers: comparison of techniques and relation to hepatic blood flow, cardiac output and oxygen uptake. Journal of Animal Science 68:1666-1673.

Köhler-Rollefson I, Mundy P and Mathias E (2001). A Field Manual of Camel Diseases: Traditional and modern healthcare for the dromedary. ITDG publishing, London. pp 1-67.

Lechtenberg KF, Nagaraja TG, Avery TB and Hartke GT (1989). Ultrasound-guided, percutaneous catheterisation of the portal vein in cattle. Agri-Practice 10:41-42.

Mohamed T, Sato H, Kurosawa T and Oikawa S (2002a). Echo-guided studies on portal and hepatic blood in cattle. The Journal of Veterinary Medical Science 64:23-28.

Mohamed T, Sato H, Kurosawa T and Oikawa S (2002b). Bile acid extraction rate in the liver of cows fed high-fat diet and lipid profiles in the portal and hepatic veins. The Journal of Veterinary Medicine Series A 49:151-156.

Mohamed T, Sato H, Kurosawa T, Oikawa S and Nitanai A. (2003a). Ultrasonographic imaging of experimentally induced pancreatitis in cattle. Veterinary Journal 165: 314-324.

Mohamed T, Sato H, Kurosawa T and Oikawa S (2003b). Transcutaneous ultrasound-guided pancreatic biopsy in cattle and its safety: a preliminary report. Veterinary Journal 166:188-193.

Mohamed T, Oikawa S, Nakada K, Kurosawa T, Sawamukai Y and Sato H (2003c). Percutaneous ultrasound-guided over-the-wire catheterisation of the portal and hepatic vessels in cattle. The Journal of Veterinary Medical Science 65:821-824.

Mohamed T, Oikawa S, Iwasaki Y, Mizunuma Y, Takehana K, Endoh D, Kurosawa T and Sato H (2004a). Metabolic profiles and bile acid extraction rate in the liver of cows with fasting-induced hepatic lipidosis. The Journal of Veterinary Medicine Series A 51:113-118.

Mohamed T, Sato H, Kurosawa T and Oikawa S (2004b). Ultrasonographic localisation of thrombi in the caudal vena cava and hepatic veins in a heifer. Veterinary Journal 168:103-106.

Mohamed T, Al-Sobayil F and Buczinski S (2012). Ultrasound-guided hepatic and renal biopsy in camels (*Camelus dromedarius*): Technique development and assessment of the safety. Small Ruminant Research 103:211-219.

Oikawa S, Mizunuma Y, Iwasaki Y and Mohamed T (2011). Changes of very low-density lipoprotein concentration in hepatic blood from cows with fasting-induced hepatic lipidosis. Canadian Journal of Veterinary Research 74:317–320.

Olesen HP, Sjøntoft E and Tronier B (1989). Simultaneous sampling of portal, hepatic and systemic blood during intragastric loading and tracer infusion in conscious pigs. Laboratory Animal Science 39:429-432.

Ortigues I, Martin C and Durand D (1996). Circadian changes in net nutrient fluxes across the portal-drained viscera, the liver, and the hindquarters in preruminant calves. Journal of Animal Science 74:895 907.

Reynolds CK, Harmon DL and Cecava MJ (1994). Absorption and delivery of nutrients for milk protein synthesis by portal-drained viscera. Journal of Dairy Science 77: 2787-2808.

Sghiri A and Driancourt MA (1999). Seasonal effects on fertility and ovarian follicular growth and maturation in camels (*Camelus dromedarius*). Animal Reproduction Science 55:223-237.

Tharwat M, Al-Sobayil F, Ali A and Buczinski S (2012). Ultrasonography of the liver and kidneys in healthy camels (*Camelus dromedarius*). Canadian Veterinary Journal. In press.