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ABDOMINAL SPLANCHNIC HAEMODYNAMICS IN A CANINE NORMOVOLAEMIC ANAEMIA MODEL AND UNCOMPLICATED CANINE BABESIOSIS: A COMPARATIVE DOPPLER STUDY.

A thesis submitted to the Faculty of Veterinary Science, Onderstepoort

University of Pretoria

in fulfilment of the requirements of the degree of

Doctor of Philosophy.

By

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DECLARATION

I, Lee M.P.K. Koma, do hereby declare that, neither I nor any other scientist has previously submitted this thesis that I am submitting to the University of Pretoria for the degree of Doctor of Philosophy, to any other university for a degree, either in part or as a whole. My promoters Prof. R.M. Kirberger, Head of the Section of Diagnostic Imaging, Prof. P. Bland van den Berg, Director of Clinical Services, Onderstepoort Veterinary Academic Hospital, and Prof. L. Scholtz, Head of the Department of Radiology, Pretoria Academic Hospital bear testimony to this.

Signed this..... day of …… in the year of our Lord ……...

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Lee M.P.K. Koma

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Prof. R.M. Kirberger

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Prof. P. Bland van den Berg

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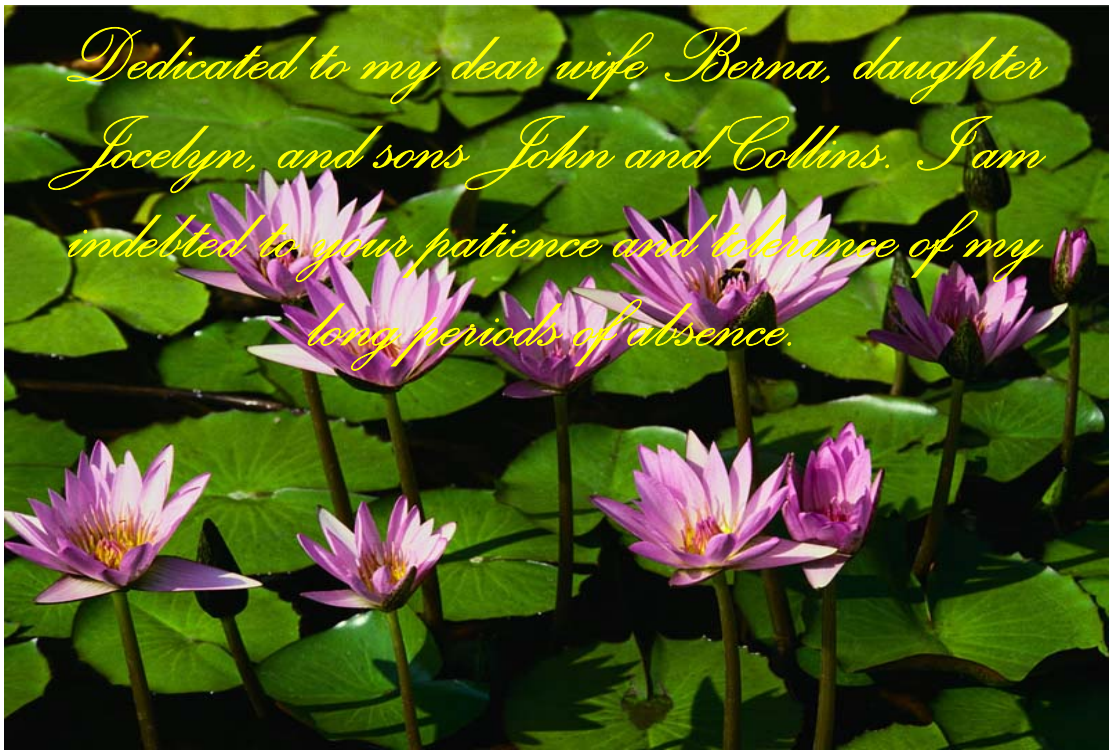
Prof. L. Scholtz


Dedicated to my dear wife Berna, daughter Jocelyn, and sons John and Collins. I am indebted to your patience and tolerance of my long periods of absence.

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ABSTRACT

This study compared uncomplicated canine babesiosis (CB) with various grades of experimentally induced normovolaemic anaemia (EA) and the physiological state (controls) in the dog using Doppler variables of the abdominal aorta and splanchnic vessels. There were 14 cases of uncomplicated CB, and each EA and control group had 11 Beagles.

There were significant increases in the abdominal aorta, cranial mesenteric artery, coeliac artery and main portal vein blood flow velocities, and in portal blood flow during EA when compared with the physiological state. There were significant reductions in resistance indices of the same vessels, and those of the hilar splenic artery. Changes were most notable during severe EA and less consistent during lower grades of anaemia.

Significant changes in renal haemodynamics were found only during severe acute EA. In contrast to other abdominal vessels, left renal artery pulsatility and resistive indices increased significantly during EA while those of the interlobar artery remained unchanged. There was a significant increase in peak systolic velocity and significant decrease in end diastolic velocity. Renal artery time-averaged mean velocity (TAV_{mean}) ($P \leq 0.008$) and end diastolic velocity ($P \leq 0.041$) were significantly lower than the corresponding variables of the aorta, cranial mesenteric and coeliac arteries during the EA but not the physiological state. The TAV_{mean} ratio was significantly ($P = 0.014$) lower during EA when compared to the physiological state, and significantly ($P \leq 0.004$) lower than the corresponding variables of cranial mesenteric or coeliac artery during the EA but not the physiological state.

There was a striking similarity between CB and EA regarding haemodynamic change patterns of Doppler variables in all vessels. In spite of this, renal resistive indices during CB were significantly higher than during EA and the physiological state.

The similarity between CB and EA haemodynamic patterns is attributed to anaemia while significant differences between them may be attributable to pathophysiological factors peculiar to CB. This observation supports the view that CB impairs renal circulation through certain mechanisms such as capillary blockage with sequestered red blood cells. Doppler ultrasonography is a useful technique for clinical investigation of haemodynamics in CB and related diseases.

Key terms: anaemia, canine babesiosis, abdominal splanchnic haemodynamics, Doppler characteristics

ABSTRAK

Die doelwitte van hierdie studie was om die Doppler veranderlikes van die abdominale aorta en splankniese bloedvate te vergelyk tussen eksperimentele normovolemiese anemie (EA), ongekompliseerde babesiose in honde (CB) en ook teenoor die normale fisiologiese status in kontrole honde.

Doppler veranderlikes van die abdominale bloedvate gedurende die normale fisiologiese status en verskillende grade van eksperimentele anemie is gemeet in 11 klinies normale Beagles, en in 14 honde met ongekompliseerde babesiose.

Daar was betekenisvolle verhogings in die bloedvloeispoed van die abdominale aorta, kraniale mesenteriese slagaar, koiliak slagaar en die hoof portale aar en in die portale bloedvloei gedurende EA in vergelyking met die kontrole groep. Daar was betekenisvolle verlagings in die weerstands indekse van dieselfde bloedvate en van die milt hilus slagaar. Veranderinge was mees merkbaar gedurende erge EA en minder gevorderd gedurende ligter grade van anemie.

Betekenisvolle renale hemodinamiese veranderinge is alleenlik gedurende erge akute anemie gevind. In kontras met ander abdominale bloedvate het die pulseer– en weerstandsindekse van die linker renale slagaar betekenisvol verhoog gedurende EA terwyl die van die interlobêre slagaar onveranderd gebly het. Daar was betekenisvolle verhogings in die piek sistoliese bloedvloeisnelheid en betekenisvolle verlagings in die eind diastoliese vloeisnelheid.

Renale slagaar tyd-gemiddelde mediane vloeisnelheid (TGMB) (P≤ 0.008) en eind diastoliese vloeisnelheid ($P \leq 0.041$) was betekenisvol laer as die ooreenkomende veranderlikes van die aorta, kraniale mesenteriese en koiliak slagare gedurende anemie, maar nie in die kontrole honde nie. Die TGMB verhouding was betekenisvol laer (P 0.014) gedurende anemie in vergelyking met die kontroles, en betekenisvol laer ($P \leq 0.004$) in vergelyking met die ooreenstemende veranderlikes van die kraniale mesenteriese en koiliak slagare gedurended anemie, maar nie in die kontrole honde nie.

Daar was ‘n merkbare ooreenkoms tussen CB and EA hemodinamiese neigings met betrekking tot alle Doppler veranderklikes vir alle bloedvate. Ondanks hierdie enersheid het CB betekenisvolle verhogings gehad vir die renale weerstandsindeks teenoor EA en die kontrole groepe.

Die algemene hemodinamiese neigings gedurende CB en EA mag toegeskryf word aan die anemie terwyl die verskille toegeskryf kan word aan spesifieke CB patofisiologiese faktore. Hierdie waarnemings ondersteun die opinie dat CB renale bloedvloei belemmer word deur verstopping van kapilêre bloedvate deur gesekwestreerde rooibloedselle. Doppler ultrasonografie is ‘n handige tegniek vir kliniese ondersoeke van die hemodinamika van CB en soortgelyke siektes.

Sleutel woorde: anemie, honde babesiose, abdominale splankniese hemodinamika, Doppler eienskappe.