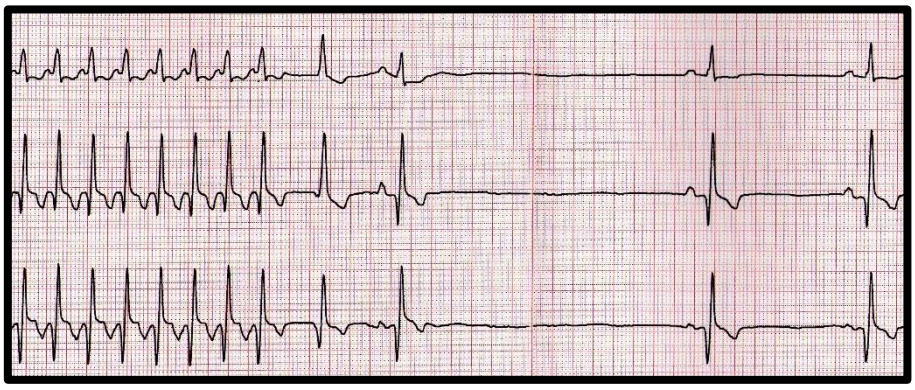
Certificate in Advanced Veterinary Practice

C-VC.2 Cardiovascular Diagnostics

Module Syllabus



Module Leader:

Luke Dutton BVSc MRes MVetMed PhD MRCVS DipACVIM (Cardiology)

American Specialist in Veterinary Cardiology

Royal Veterinary College, Hawkshead Lane, North Mymms, Hertfordshire AL9 7TA

Tel: +44 (0)1707 666201 Email: certavp@rvc.ac.uk www.rvc.ac.uk/certavp

March 2025

Contents

Learning outcomes

The module is focused on making a diagnosis of cardiovascular disease using the appropriate techniques. It is not concerned with the therapeutics of animals with cardiovascular disease as this is the concern of module C-VC.3.

The module is aimed at veterinary surgeons in private practice, or at a veterinary school with a substantial case load of small or large animals, or a mixture, of which a significant number have primary cardiovascular disease, or require **thorough** examinations of your cardiovascular system for investigation of other systemic illnesses, or injury. At least 200 of these should be examined and assessed primarily by you.

The module may be taken from a large animal or a small animal perspective, or a mixture of the two. It is suggested that candidates intending to proceed to a Certificate in Advanced Veterinary Practice (Cardiology) via modules C-VC.1 and C-VC.3, will present a C-VC.2 made up of a balanced distribution of species with at least 2 being represented. Alternatively, if you are intending to proceed to the advanced clinical practice (cardiology) with a large animal/equine bias) via Equine Practice, the case diary should be made up of 90% large animals.

For a designated Certificate in Advanced Veterinary Practice (Veterinary Cardiology) you must complete this module, module C-VC.1 (Cardiovascular Anatomy, Physiology and Pathology), module C-VC.3 (Cardiovascular Therapeutics), a fourth 10 credit module of your choice and an RCVS synoptic assessment.

Learning topics

At the end of the module, you should be able to:

- To select appropriate diagnostic techniques for small or large animal patients based on their history and clinical findings (auscultation, physical examination)
- To be able to diagnose acute cardiac failure and shock
- To show an understanding of the balance between patient care and patient stabilisation before extensive diagnostic procedures are undertaken
- To show competence in acquiring the appropriate diagnostic materials from the tests and procedures selected, for example, electrocardiographs, radiographs and

echocardiographs must all be of diagnostic quality and the scope of each examination sufficient to satisfy the diagnostic question being asked

- To have the ability to critically assess and measure the diagnostic material once it has been derived
- To show competence in interpreting all of the diagnostic material that you have acquired from each case and integrating all of the elements of your diagnostic work up to determine a final diagnosis
- To provide an accurate diagnosis after your series of diagnostic tests have been completed

For the purposes of the case diary you **MUST** have performed a full clinical examination on each animal entered

1. Clinical examination:

- Auscultation—presence of murmurs, gallop sounds, arrhythmias or inappropriate rates, examination of the respiratory system
- Pulse palpation—rate, character and rhythm
- Mucous membranes and peripheral perfusion—assessment of mucous membrane colour and refill time and adequacy of peripheral perfusion
- Examination for extra-cardiovascular manifestations of cardiovascular disease and failure

You are then expected to choose appropriately from the following core list of ancillary diagnostic aids, or if clinical examination is sufficient to make a final diagnosis of the cardiovascular abnormality e.g. in a case of hypovolaemic shock, you can proceed to this as a final diagnosis in the case diary.

2. Ancillary Diagnostic aids

a) Electrocardiography

You must then be able to:

- Calculate heart rate
- Assess heart rhythm
- Assess cardiac conduction and waveform shapes
- Understand the application of Holter or other long term ECG monitors

b) Measurement of arterial blood pressure

Direct and indirect methods

c) Radiology

- You should understand the basic principles of radiography and recognise common film faults
- Additionally you should demonstrate an understanding of:
  - radiographic anatomy of the cardiovascular and respiratory system
  - radiographic changes in all organs associated with cardiovascular disease
  - radiographic changes in cardiac failure
  - principles and indications for angiography

d) **2-D and M-mode Echocardiography**—*acquisition, recognition, measurement and interpretation of standard 2D and M-mode images;*

You should

- understand the basic principles of echocardiography, recognise common faults and be familiar with and capable of obtaining the standard views of the heart appropriate to your species bias
- recognise and describe normal echocardiographic anatomy. (You should possess a detailed knowledge of normal cardiac anatomy of the dog, cat and horse and of the variations with breed and age, as appropriate to the case diary
- an understanding of how common cardiovascular diseases affect the cardiac chambers and the standard measurements made
- a knowledge of common artefacts and an understanding of the potential pitfalls of an echocardiographic study

e) The basic principles and applications of Doppler echocardiography including knowledge of common artefacts and an understanding of the potential pitfalls of Doppler echocardiographic methods. We encourage you to demonstrate Doppler echo skills in your case reports, appropriate for the level of an Advanced Practitioner in this subject.

f) **Laboratory tests**—in particular renal function, liver enzymes, electrolytes, blood gases and haematology. Knowledge of specific laboratory tests for cardiac disease e.g. cardiac troponins etc.

For radiography and echocardiographic images, you will be expected to demonstrate via your case reports that you are able to recognise and explain faults, when present in the diagnostic material.

Enrolment guidance

Before embarking on this module, you should fulfil the following criteria:

a) You should have completed module B-SAP.1.
b) If you are only enrolling for the C cardiology modules with RVC, it is **highly recommended** that you write one report from module B-SAP.1. This will be reviewed by the assessors prior to assessment of any C module work. If you have completed the B-SAP.1 module at another institution, one report may be submitted for feedback.
c) It is your responsibility to ensure that you have access to sufficient cases to produce adequate material for the module.

Coverage of this module may be integrated with others, particularly other B and C modules. You will normally have completed A-FAVP.1 Foundations of Advanced Veterinary Practice module, and at least one of the practice B modules, before undertaking a C module, although you can choose to work through modules in a different order if you wish. In whichever order modules are tackled, compliance with best practice for all the topics covered by module A-FAVP.1 will be expected whenever these are appropriate in C modules. For example, awareness of, and compliance with, all relevant legislation, welfare and ethical principles will be required throughout.

Before embarking on any module, you are advised to plan a structured programme of continuing professional development to help you achieve your objectives. Involvement in ‘learning sets’ and networks of other candidates working towards the same or similar modules is encouraged; this should be initiated by the candidates themselves via RVC Learn. The RCVS considers that you will need advisers/mentors to support you through the programme; you are free to choose your own advisers/mentors.

Assessment

- One case report can be submitted for review prior to being marked. This is only permitted once per candidate per discipline.

- Case diary of 50 cases with broad range of diagnoses - list the case details, diagnostic procedures and management (where appropriate) for each case.

- At the end of the case diary you should include a 1,000 word synopsis of what you have learned from the cases.

- Two case reports, each of up to 2,000 words in length.

- Article critique (up to 800 words) from a chosen list of journal articles about an aspect of diagnosis in veterinary cardiology and how this article would alter your management of cases.

- A one hour examination to consist of multiple answer questions and/or short answer questions.

Assessment weighting

- 1 x Case Diary with Synopsis 25%

- 2 x Case Reports 30%

- 1 x Article Critique 15%

- 1 x Exam 30%

Annual assessment timetable

Early October	'Student check in' – online Teams call with the CertAVP team and other students
11th December	You are given the opportunity to have one case report per discipline reviewed prior to marking (therefore only one for all C-VC modules). Please submit your report by this date if you haven't already had a review.
19th January	Case report feedback returned to you
Late January	'Student check in' – online Teams call with the CertAVP team and other students
1st March	All written work to be submitted
1st May	You will be notified of your results
Late May	'Student check in' – online Teams call with the CertAVP team and other students
Mid July	Formal examination to be held in July - date to be confirmed
Mid August	You will be notified of your results

You are strongly advised to have a supervisor with which you can discuss cases. Ideal supervisors would have post-graduate qualifications in your area of interest. The module leader will not be discussing case management with any candidate.

Learning support

Learning support is provided to aid self-directed learning and to provide easy access to published articles. You will be given a username and password which will allow you to log on to 4 different systems:

- **RVC Learn (http://learn.rvc.ac.uk/)**
  - Articles on cognitive learning behaviours
  - Articles on cardiovascular disease in veterinary species
  - A selection of articles for you to pick one to critique as part of your assessment
  - Access to discussion forums that are used by all CertAVP candidates as well as RVC tutors. The forums can be used to discuss any topic relevant to the CertAVP cardiology C modules or simply to find out who else is out there!
  - Access to a webinar which contains guidance on preparing written work for the cardiology C modules
  - Access to the RVC online library. This is invaluable when researching literature for writing up case reports. This means that (with rare exception) all journal articles that you want to view can be downloaded to your PC with a few mouse clicks. This includes original research articles as well as review articles and case reports.
  - There are also several CPD courses run each year at the RVC that support some of the learning outcomes for C-VC modules. CertAVP candidates receive a 20% discount on RVC CPD courses – please contact the CertAVP office for further details.

- **RVC Intranet (https://intranet.rvc.ac.uk)**

Access to all information available to all RVC students and employees, for example, news, events, policies, committees, services, Library, IT helpdesk, etc.

- **Athens (http://www.openathens.net/)**

A huge amount of any library's information is now available online, e.g. electronic journals, e-books and databases. 'Athens' is a system used by UK universities for controlling access to these type of online services and with your username and password, you can access many of a library's online databases, electronic journals and e-books seamlessly.

- **Webmail (https://webmail.rvc.ac.uk)**

You are given an RVC email address, which is **compulsory** to use for CertAVP communication and submission of work.

Case diary guidelines

The scope of the examination is related to the recognition and diagnosis of conditions that commonly affect the cardiovascular systems of the domestic species that are regularly encountered in general veterinary practice. Therefore, in selecting cases for the diary, you should choose a representative sample of cases to encompass these conditions:

- acute cardiac or cardiovascular failure
- chronic cardiac failure
- acquired heart disease, including both valvular and myocardial disease
- congenital heart disease
- pericardial disease
- cardiac arrhythmias
- thromboembolic disease

An acceptable case diary should have ***at least*** one case representing each of the preceding conditions. Case diaries representing only one species and cases presenting for screening are not acceptable. Cases with the same disease (e.g. degenerative mitral valve disease) should not represent more than 20% of the diary and no more than 10% of cases should be listed as second clinician. Acceptable abbreviations can be found in Appendix 1 at the end of this document, all other abbreviations must be explained.

The diary is meant to be a continuous record of all cardiology cases performed by you up to the time of submission therefore they should be listed in chronological order. The same procedure in a different patient can be used again. Cases can be collected from up to 12 months prior to the date of enrolment on the CertAVP programme.

Information to be included in the diary:

a) Date
b) Name / case number / unique identifier
c) Signalment: including breed, age, sex
d) Brief list of presenting signs e.g. cough, collapse, exercise intolerance
e) Abnormal auscultation and physical exam findings pertinent to the cardiovascular system; murmur, gallop, arrhythmia, heart rate if abnormal, other; e.g. inspiratory rates. Increased respiratory rate, abdominal distension, pyrexia etc.
f) List of ancillary diagnostic tests in the order in which they were performed and their most significant outcomes, for example:

- ECG: sinus rhythm
- Radiographs: mild LA enlargement
- Echocardiography: thickened mitral valve leaflets and mild left atrial enlargement on 2D, mild to moderate mitral regurgitation detected by colour Doppler

g) Final diagnosis
h) Treatment
i) Follow up

Preparing the case diary synopsis

A 1,000 word synopsis essay is required to accompany the case diary. This synopsis might include discussion of what might have changed in your approach to a new case, any new procedures or investigations that are now considered during case investigations, any additional reading which was helpful, and/or any unexpected features of a case which might influence decision making or case management in the future.

This is a good opportunity to explain or clarify any aspects of your case diary to the examiner and to state any plans you have for future study. Wherever appropriate use your further reading and available evidence to support any statements that you make. You will probably find it easier to write your reflective synopsis after you have finished your case reports as well as once your case diary is completed. You must stay within the word limit given or the work will be returned unmarked.

Example cardiology case diary (based on ECVIM cardiology case diary)

Date	Case number and client name	Age, sex, breed	ECG	XRAY	MMODE	2D	DOPPLER	Other diagnostics	Diagnosis	Treatment and follow-up
5.1.09	697708 Smith	12 yo MN LABR	x	x	x	x	x	Biochemistry, electrolytes	DCM, left sided CHF, VPCs, 24h Holter	Furosemide, Pimobendan, Benazepril Recheck 1 Week
5.1.09	697718 Brown	9 yo FN DSH	x	x	x	x	x	Doppler systolic blood pressure	HCM stage B1	Repeat echo 9-12 months

Example key:

MN	male neutered	FN	female neutered
LABR	Labrador retriever	DSH	Domestic Shorthair
CHF	Congestive heart failure	VPCs	Ventricular premature complexes
HCM	Hypertrophic cardiomyopathy		

Case report guidelines

The two case reports should be selected to demonstrate that you have developed proficiency in the skills and understanding of the learning objectives outlined in the module content. **It is important that the diagnosis is sufficiently justified by the case material provided, including suitable images.** The lack of images confirming a diagnosis will result in a case report failing, no matter how high the standard of the case report text.

Discussions should include personal reflection which should critically evaluate your management of the case. Appropriate cases might include those where a candidate can discuss what went well, what went badly, challenging decision making and alternative management options. It is recommended that you apportion no more than 1,000 words to the case description and at least 1,000 words to the case discussion. Case discussion ***should*** be limited to commentary on the diagnostic investigations. No marks will be awarded for commentary on therapeutics unless it directly relates to diagnostic investigations. However, if your therapeutic choices are considered to endanger patient safety, this will have a resultant effect on the final mark.

The use of appendices for tables and figures is discouraged. These should feature in the body of the text at an appropriate location. Any data in an appendix may not be marked, and therefore appendices should be avoided where possible.

The following frame work should be used as a guide to the structure of a case report:

- Identification of patient
- Case summary (recommended length 1,000 words), including:
    - Summary of case presentation
    - Summary of diagnostic findings
    - Final diagnosis
    - Management
- Discussion (recommended length 1,000 words) exclusively about cardiovascular diagnostics and pertinent to your case
- References; please use the style of the Journal of Small Animal Practice.

Case reports are intended to be written at Master's degree level. It can be challenging to include the level of detail required to reach this level within the word limit provided. However, concise scientific writing is one of the skills necessary to work to this level.

A few tips:

- Avoid repeating information; however relevant it is, marks can only be awarded for a particular piece of information once
- Avoid including information in the discussion that is not relevant to the learning objectives of the module
- Avoid the temptation to select cases that are too complicated to adequately discuss in 2000 words

Note that cases selected do not need to represent ideal or perfect management, and frequently well-written reports highlight where things went wrong or how they could have been done differently. It should be borne in mind that patient safety, however, is paramount. Discussion of how management could be improved if alternative equipment, etc, was available, or if costs allowed additional testing often provides a valuable component of the case report. This should be explained in the context of how it would be helpful, rather than listing all the additional equipment/drugs etc that would be used in a different setting.

Case reports should be written in the third person in a style suitable for publication in a Journal (for example Journal of Small Animal Practice). You are expected to demonstrate a high standard of literacy and please ensure that any spelling and grammatical errors have been corrected – not doing so will result in a negative effect on your final mark.

Images should be included in the body of the case report, rather than in an appendix. You must include any images that you think are relevant, as these enhance your report and enable examiners to assess your interpretation of diagnostic tests. Normal ultrasound images need not be included, but if questions arise as to your level of practical capability, normal images may help to support your standard of clinical work. Abnormal images should always be included; to not do so will affect your final mark.

The word limit is 2,000 words per report. Tables, figure legends, appendices and reference list are NOT included in the word count. The report title and titles within the report ARE included. You should not put important information, such as the physical examination, into a table to avoid the word count; only numerical data should appear within a table (such as laboratory results). In the interests of fairness to all candidates the word count is adhered to strictly and reports that exceed it will be returned unmarked.

Article critique guidelines

A selection of articles to critique are available on Learn. You need to write about how your chosen article would alter your management of cases. Include comments on how the paper has affected your own practising of cardiology in relation to diagnosis and how this may have informed your learning. You are encouraged to make reference to related veterinary literature in the reference critique.

Examination

The exam paper for C-VC.2 is multiple answer questions and/or short answer questions, to include theoretical knowledge as well as interpretation of gross pathology images.

It is a one hour exam and each question will show the mark assigned. Sample exam questions are available on Learn and you are encouraged to work through the samples as part of your exam preparation.

The RVC Study Skills team is available to assist with any revision techniques.

Instructions for submitting work

Each piece of work you submit must be anonymous and please ensure that your work includes this table on the front page:

Student number:	
Module:	C-VC.2
Piece of work:	*case report 1, case report 2 etc*
Word count:	

Contact the CertAVP office if you need a reminder of your student number (found on your Rover email when you first enrolled). All work is submitted online via Learn; you will be given further instructions when you enrol.

The content of case reports must also be anonymous, e.g., removing practice details from discharge notes or laboratory reports.

References should be properly cited in the text, in accordance with the style in the Journal of Small Animal Practice (JSAP). Do not list references that were not cited in the text or vice versa. We recommend using Harvard referencing and you will find it very helpful to use a program such as Endnote® or Reference manager® to organise your references.

You may include appendices but please note that the examiners are not obliged to read them (so please do not include essential case information; omitting this from the body of the case report will affect your mark). Laboratory reports may be included here but all abnormalities need to be written in the text and reference ranges must be included. It is acceptable to scan printed reports rather than re-type them if you prefer, but any case details or details of your name or practice must be blanked out.

All written work submitted to the Royal Veterinary College is passed through plagiarism detection software. Work submitted for this module should not have been submitted for any other courses at RVC or other institutions.

Suggested reading

The following list is given as a guide as to where to start and for this reason cannot be considered ‘complete’. We also don’t expect candidates to read texts from cover to cover or to use all of the texts listed, however we do recommend you make use of the most recent edition of textbooks where available. We apologise if candidates feel a particular favourite is missing - feel free to use the Learn discussion board to pass on additional suggestions to other candidates.

Essential reading:

- Manual of Canine and Feline Cardiology. *Eds:* LP Tilley, FWK Smith Jr, M Oyama, MM Sleeper. 2015, Elsevier Ltd, London.
- Santilli, R., Moïse, S., Pariaut, R. and Perego, M., 2019, June. Electrocardiography of the dog and cat.: Diagnosis of arrhythmias. Edra.

General cardiology:

- Feline Cardiology. *Eds:* E Côté, KA MacDonald, KM Meurs KM, MM Sleeper. 2011, Wiley Blackwell, Chichester.
- Topics in Cardiology. An Issue of Veterinary Clinics: Small Animal Practice (The Clinics: Veterinary Medicine). Volume 47, Issue 5, pp 955-1122 September 2017. *Ed:* João S. Orvalho. TheClincs.com
- Robinson R and Borgeat K (2016). Cardiovascular Disease, Ch21 in Duke-Novaskovski T, de Vries M, Seymour C (Eds), BSAVA Manual of Canine and Feline Analgesia and Anaesthesia, BSAVA Publishing, Gloucestershire, UK.
- BSAVA Manual of Canine and Feline Cardiorespiratory Medicine. *Eds:* V Luis Fuentes, LR Johnson, S Dennis. 2010, BSAVA, Gloucester.
- Cardiovascular Disease in Small Animal Medicine. *Ed:* WA Ware. 2007, Manson Publishing Ltd, London.
- Cardiology of the Horse. *Eds:* C Marr, M Bowen. 2010, Elsevier Ltd, London.
- Cardiology. An Issue of Veterinary Clinics: Exotic Animal Practice (The Clinics: Veterinary Medicine). Volume 12, Number 1, Feb 2009. *Ed:* JJ Heatley. TheClincs.com

Cardiac auscultation:

- Rapid Interpretation of Heart and Lung Sounds: A Guide to Cardiac and Respiratory Auscultation in Dogs and Cats. FWK Smith Jr, BW Keene, LP Tilley. 2006, Saunders Elsevier, St Louis.

- Cardiac Auscultation and Phonocardiography in Dogs, Horses and Cats. *Eds:* C Kvart, J Häggström. 2002, Clarence Kvart, Uppsala.

Electrocardiography:

- Willis, R., Oliveira, P. and Mavropoulou, A. eds., 2018. *Guide to canine and feline electrocardiography*. John Wiley & Sons.
- Rapid Review of ECG Interpretation in Small Animal Practice. *Eds:* MA Oyama, MS Kraus, AR Gelzer. 2013, Manson Publishing Ltd, London.
- Small Animal ECGs: An Introductory Guide. *Ed:* M Martin. 2007, Blackwell Publishing Ltd, Oxford.
- ECG for the Small Animal Practitioner (Made Easy). *Eds:* LP Tilley, NL Burtnick. 1999, Teton New Media, Jackson.

Radiography:

- Textbook of Veterinary Diagnostic Radiology. *Ed:* DE Thrall. 2012, Saunders Elsevier, St Louis.
- BSAVA Manual of Canine and Feline Thoracic Imaging. *Eds:* T Schwarz, V Johnson. 2008, BSAVA, Gloucester.

Echocardiography:

- BSAVA Manual of Canine and Feline Thoracic Imaging. *Eds:* T Schwarz, V Johnson. 2008, BSAVA, Gloucester.
- Veterinary Echocardiography. *Ed:* JA Boon. 2011, John Wiley & Sons, Chichester.
- Small Animal Diagnostic Ultrasound. *Eds:* TG Nyland, JS Mattoon. 2002, WB Saunders, Philadelphia.
- Otto, C.M., 2023. *Textbook of clinical echocardiography*. Elsevier Health Sciences.

Appendix 1: acceptable abbreviations for case log

ACDO: Amplatz Canine Duct Occluder
AF: atrial fibrillation or flutter (denote which is being referred to at least once prior to using abbreviation)
AI: aortic insufficiency
AoV: aortic valve
AR: aortic regurgitation; synonym for aortic insufficiency
ARVC: Arrhythmogenic right ventricular cardiomyopathy
AS: aortic stenosis
ASD: atrial septal defect
ATE: arterial thromboembolism
AV: atrioventricular
AVB: atrioventricular block (1AVB: 1st degree atrioventricular block 2AVB: 2nd degree atrioventricular block 3AVB: 3rd degree atrioventricular block)
AVSD: atrioventricular septal defect
BV: balloon valvuloplasty
CHF: Congestive heart failure
CM: cardiomyopathy
CT: computed tomography
CTD: Cor Triatriatum Dexter
CTS: Cor Triatriatum Sinister
CdVC: caudal vena cava
CrVC: cranial vena cava
DCM: Dilated cardiomyopathy
DLVOTO: Dynamic left ventricular outflow tract obstruction
DRVOTO: Dynamic right ventricular outflow tract obstruction
DVD: Degenerative valve disease (followed by Stage A, B1, B2, C, D) - acceptable as an alternative to MMVD as “Myxomatous” is technically a histopath diagnosis.
HCM: Hypertrophic cardiomyopathy
HF: heart failure
HOCM: Hypertrophic obstructive cardiomyopathy
HSA: hemangiosarcoma
HW: heartworm
HWD: Heartworm disease
LA: Left atrium/atrial

LAE: Left atrial enlargement

LAu: left auricle

LPA: left pulmonary artery

LV: Left ventricle/ventricular

LVEH: Left ventricular eccentric hypertrophy

LVCH: Left ventricular concentric hypertrophy

MMVD: myxomatous mitral valve disease (followed by Stage A, B1, B2, C, D)

MPA: main pulmonary artery

MRI: magnetic resonance imaging

MS: mitral stenosis

MV: mitral valve