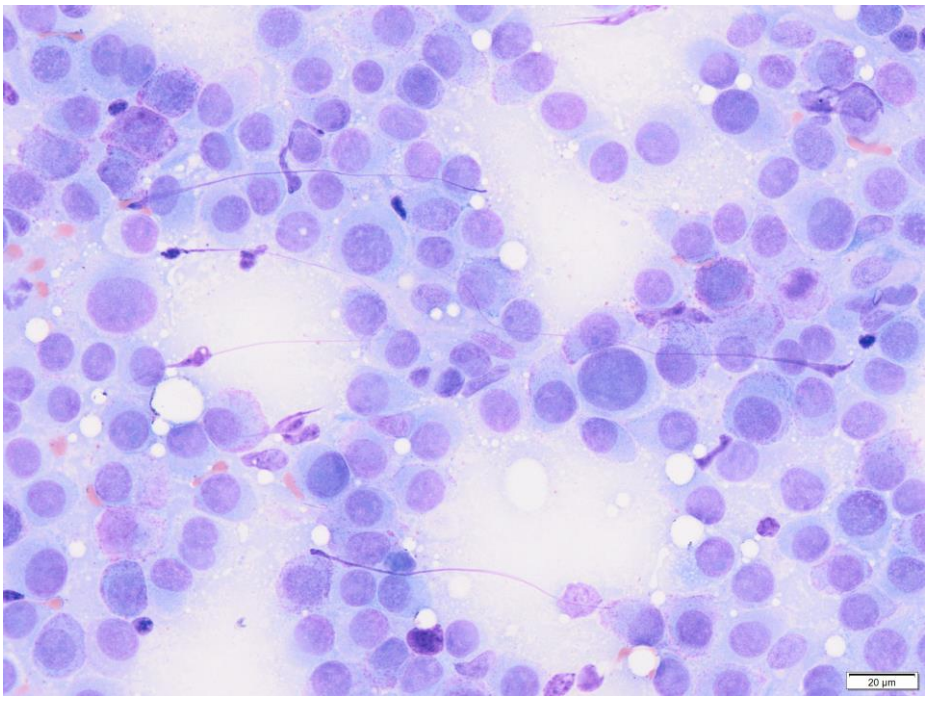
Royal Veterinary College
University of London

Certificate in Advanced Veterinary Practice

C-VP.2 Veterinary Pathology

Clinical Pathology - Laboratory Diagnostics

Module Outline



Module Leader:

Dr Emma J Holmes BVetMed, MVetMed, DipACVP, MRCVS
Senior Lecturer in Clinical Pathology

Royal Veterinary College, Hawkshead Lane, North Mymms, Hertfordshire AL9 7TA
Tel: +44 (0)1707 666201, Fax: +44 (0)1707 666877, Email: certavp@rvc.ac.uk www.rvc.ac.uk/certavp

Introduction

The objective of the module is to enable you to consolidate your clinical knowledge, and to develop an in depth understanding of the application of that knowledge in a practice environment in relation to laboratory medicine diagnostics. The module is aimed at general practitioners who want to develop their confidence in the selection and interpretation of appropriate diagnostic tests for their clinical cases.

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

a) You should have completed a B Practice module.
b) If you have completed a B Practice module at another institution, you may submit one report for feedback by RVC assessors. If you are only enrolling for the Pathology C modules, it is highly recommended that you write one report from your relevant B Practice module and this will be reviewed by the assessors prior to assessment of any C module work.
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 have completed the Foundations of Advanced Veterinary Practice module (A-FAVP.1) and at least one of the practice B modules, before undertaking a C module. 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.

You are advised to plan a structured programme of continuing professional development to help you achieve your objectives. Involvement in ‘learning groups’ and networks of other candidates working towards the same or similar modules is encouraged. The RCVS suggests having advisers/mentors to support you through the certificate.

Module Aim

This module aims to enable you to consolidate your clinical knowledge, and to develop an in depth understanding of the application of that knowledge in a practice environment in relation to laboratory medicine diagnostics.

Learning Outcomes

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

- Comprehensively understand the pathophysiological basis of changes in laboratory test results.
- Interpretate laboratory test results in relation to clinical findings and other diagnostic test results
- Integrate results from different diagnostic tests to help reach a clinical diagnosis
- Review and constructively criticise current literature on the specialty, so you can assess the relevance to your current practice
- Utilise your understanding of evidence-based medicine and decision analysis to choose the appropriate diagnostic test(s) and develop practical diagnostic protocols
- Recognise when a case is unusual and become familiar with information resources available to enable you to deal with such cases
- Recognise when a case is beyond your personal or practice capabilities for continued testing and monitoring (i.e. when test referral or case referral is indicated).

Structure

1. Basic guidelines for set up and maintenance of an in-practice laboratory

- Choosing and evaluating equipment and its performance for haematology, biochemistry, for in house/office/near patient testing
- Routine maintenance and calibration of equipment
- Standardisation and quality control of laboratory tests, internal and external quality control schemes. Quality assurance schemes. Procedures to apply when these are out of control
- Standard operating procedures (SOP'S) for all tests and equipment
- Preparation of good quality blood films, cytology smears from fine needle aspirates (FNA) and fluid samples
- Microscopy, blood films, urine analysis and identification of common endo- and ectoparasites
- Handling and evaluation of haematology, chemistry, microbiology, and cytology samples for their condition and suitability for transport to reference laboratories for testing
- Guidelines for choosing an external testing laboratory for both routine testing and special tests (for example, endocrinology, immunology)

2. Cytology

- Understand the relative advantages/disadvantages of cytology, needle aspirate and biopsies, impression smear cytology and histology, and their integration in case analysis
- Guidelines for choosing an external testing laboratory for both routine testing and special tests (e.g. endocrinology, immunology)

3. Laboratory data analysis; general principles

- Quality of samples
- Effects of interferences, for example, aging, haemolysis, lipidaemia, drugs on test results
- Use of reference intervals (normal values) for interpretation of results

4. Evaluation of results in relation to clinical and historical information

- Evaluation of initial in house and /or external haematology and chemistry results as a basis for assessing the need for further special testing (e.g. endocrinology, immunology, virology)

5. Special species (select one of the following)

a) Small mammals (including rabbits)
b) Large companion animals (including horses)
c) Food and production animals (including poultry)
d) Other – birds, reptiles etc (including smallholders' poultry)

For the chosen group:

- Use of laboratory tests in the diagnosis of anaemia and other haematopoietic abnormalities and an understanding of the pathophysiology of the changes
- Evaluation of blood films
- Cytological evaluation of common samples (e.g. fluids, aspirates, ear swabs, urine)
- Use of laboratory tests as aids in the diagnosis and monitoring of diseases i.e. renal, hepatic, gastrointestinal, endocrine, neoplasia, infectious disease

Mentors

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.

Assessment Strategy

The following form the assessment requirements for the module:

- A **case diary** of **20 cases** documenting your experience throughout the module. The case diary should demonstrate a varied range of appropriate testing and demonstrate improvement and development across the diary. Case selection should include a mix of classic cases with some more complex cases to document your development.

- At the end of the case diary, a **1,000-word synopsis** of what you have learned from the cases is required. This might include what has changed in your approach to a case, any new procedures or investigations that are now considered, any additional reading which was helpful, and/or any unexpected features of a case which will influence decision making in the future.

- **Three case reports**, each of up to 1,500 words in length. These cases should be selected to demonstrate your ability to evaluate and integrate haematological, cytological, clinical chemistry, urinalysis and endocrine data, to identifying the abnormal (or normal, but unexpected) results, list the differentials for the abnormal values, and describe the pathomechanisms behind the changes in the context of the most relevant differentials.
    - *A **mini case diary** of 5 cases and **one case report** can be submitted for review prior to final versions being marked.*

- **One-hour practical exam** including three cases to evaluate blood films and cytology slides with common abnormalities (two haematology and one cytology) and 10-15 short answer/MCQs.

Assessment weighting

- Case diary with synopsis 33%
- Case reports 33%
- Exam 34%

Annual assessment timetable

1st December	If you are submitting work for assessment on the following dates, please inform the CertAVP office
15th December	You are given the opportunity to have a mini case diary and one case report reviewed prior to marking. Please submit these by this date if you haven't already had a review.
1st February	Case diary and report feedback returned to you
16th March	Case diary, synopsis and case reports to be submitted
16th May	You will be informed of the outcome/marks of your submitted work
Early July	Practical examination to be held (date to be confirmed)
Early September	You will be notified of your exam result and module pass

Learning support activities

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:

1. RVC Learn (http://learn.rvc.ac.uk/)

- Interesting articles to read
- 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 pathology C modules or simply to find out who else is out there!
- Access to presentations from the CertAVP Induction Day
- 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. IT and Library support is available for this facility (email library@rvc.ac.uk or helpdesk@rvc.ac.uk).
- There are also several CPD courses run each year at the RVC that support some of the learning outcomes for C-VP modules. CertAVP candidates receive a 20% discount on RVC CPD courses – please contact the CertAVP office for further details.

2. 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.

3. 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.

4. Email (http://mail.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

Cases can be collected from up to 12 months prior to the date of enrolment on the CertAVP programme. The case diary should include the following details

- Case name
- Date
- Examination
- Biochemistry
- Haematology
- Urinalysis
- Additional Testing
- Diagnostic Assessment
- Differential diagnoses considered
- Diagnosis
- Comments

More information rather than less is preferred, and the module leader would like ideally to see the analyte values and the reference intervals for the abnormal analytes, although normal analytes need not be included. This could either be covered through inserting the data into the column on biochemistry, haematology, urinalysis, and the additional testing column, or through attaching the original reports.

The aim of the case diary is to demonstrate that you have exposure to an appropriate range of cases over the time period that you study for the C-VP.2 module. Therefore, we strongly recommend you include at least 5 cases each where haematology, cytology, and biochemistry played a **major role** in the diagnostic workup. These do not have to be at specialist level, but we need to see evidence that you routinely and appropriately apply all aspects of laboratory testing in practise

A secondary aim is for you to demonstrate to the examiners that you are investigating and managing cases appropriately. If (for example) an important diagnostic test is missing from a particular case early on in the diary, the examiners would expect to see evidence of you improving your diagnostic skills and including such a test in a similar case later on in the diary. Conversely whilst appropriate and complete investigation is ideal, the examiners are keen to see that indiscriminate testing is not performed.

The examiners appreciate that collating cases in first opinion practice may result in including animals without a confirmed diagnosis and/or that underwent limited work-up for various reasons. We encourage you to include cases that are the best examples of your case load but we will accept a smaller proportion of cases that have a presumptive diagnosis and those that had limited work-up.

For either you should indicate this by indicating e.g. ‘presumptive diagnosis’ or ‘limited investigation due to .....’.

The examiners do expect to see a moderate number of common conditions within the case diary when you work in general practice. It is important to include some of these cases to demonstrate your investigation and management of these conditions. However, we advise against including large numbers of animals with common conditions as this suggests that you are not exposed to a varied enough caseload. Including more than 5 cases with the same or very similar diagnosis is not advised. Conversely, we do not expect you to have seen every type of disorder that might be included within the learning objectives (especially rare disorders).

The following guidelines will help with compiling your case diary:

- Cases should be submitted in chronological order.
- The diary must be able to be viewed on one page when reading from left to right (landscape).
- Cases can be collected from up to 12 months prior to the date of enrolment on the CertAVP programme. Please note that the learning involved in studying for a C module should enhance your case management, therefore if all cases are selected from the period prior to enrolment this might adversely affect the quality of the diary.
- We encourage the use of abbreviations where appropriate (e.g. UA for urinalysis, U/S for ultrasound) but you must include a key to your abbreviations.
- Please include the values of relevant abnormal test results as well as reference intervals, although the latter may be included as a list at the end if they are the same for all cases.
- We strongly advise that you record potential cases directly into a spreadsheet as you go along once you have enrolled onto the C-VP.2 module. This will save time nearer to the submission date. Any unwanted cases can easily be removed.
- As a general guideline, we recommend including at least 5 cases where haematology played a major role, 5 cases where cytology was used for the workup, and 5 cases where biochemistry and/or urinalysis were key for reaching a diagnosis.
- Try to avoid including cases when the management was predominantly medical or surgical with minimal clinical pathology-based investigation.
- Whilst the case diary is meant to be a brief summary of the case, do include detail where needed. If physical examination was normal then state ‘normal PE’ for example. Bear in mind what minimum information the examiner requires when assessing a case presented in this format.
- The diary should be written using scientific terminology e.g. fluid therapy rather than ‘iv drip’. Using this example it would be even better to state ‘crystalloid intravenous fluid therapy’.
- The three cases that you choose to write up as case reports are eligible to be included in the case diary.

- Cases that have already been submitted for any other examination or assessment are not eligible to be used in the CertAVP.
- Sample work is available on Learn.

Reminder: In the case diary we want you to demonstrate a broad exposure to clinopathologic cases which demonstrates a varied range of appropriate clinical testing. There should be evidence of improvement and development across the case diary which should include a mix of classic and more complex cases.

Case diary synopsis guidelines

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 demonstrate reflection and explain or clarify any aspects of your case diary to the examiner, stating any plans you have for future study. Wherever appropriate use your further reading and available evidence to support any statements that you make – further examples of this are given in the assessment webinar available on the Learn C module homepage. Examples of reflective essays are also provided although please note that there is not a specific format that must be followed. 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.

Case reports

Select your cases from a range of commonly presented conditions which fall within the learning topics for the chosen module. Ideally, cases that have been well investigated and followed-up will be chosen, and we do expect these to be your best clinical pathology-related case examples. Although cases may be worked up collaboratively you must be the primary clinician and have been actively involved in the diagnostic and therapeutic decision making for the cases you present. -

Ideally, you will choose cases that span all or most of the learning topics rather than choosing cases that are similar to one another. We can assess your approach to cases, clinical reasoning and knowledge more effectively if the cases chosen represent a range of different disease processes, diagnostic work-up and management.

If you are unsure about case selection please consult your mentor or the CertAVP Manager for further advice. As a guide the following cases usually represent poor case selections:

- Rare or overly complicated cases.
- Cases that do not enable you to demonstrate your problem solving ability, clinical reasoning and ability to perform appropriate treatment and case follow-up. This might include cases with an obvious diagnosis on presentation, those with limited clinical pathology findings and those cases for which treatment and follow-up are very simple or minimal.
- Cases without a diagnosis or lacking appropriate investigation to substantiate a given diagnosis.
- Cases whose diagnosis is substantially made by post-mortem examination.
- Cases that are investigated and managed largely at a referral centre rather than by you.

We expect that you will build on the writing skills already demonstrated in your B module essay writing, whilst taking into consideration that for the C modules, a more classic scientific case report is expected. We hope to see evidence of your problem solving skills and clinical reasoning.

We expect case reports to be written in a succinct and logical manner with the use of tables and full clinicopathological data including reference intervals. Ensure that all tables and any figures are correctly labelled and appropriate legends are included. It is helpful to include full diagnostic test results for the examiners' information (within an appendix if necessary) and details of external laboratories if used (see also comments below).

The case report 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. You may use well-known abbreviations as long as these are explained in an appendix.

Case reports should be set out in the following order (where relevant):

- Signalment
- History and clinical signs
- Physical examination findings
    - Ensure that these sections contain all relevant information about the presenting problems as well as physical examination findings. For many medical cases history and physical examination are vital to defining the problem/s and making the correct diagnosis. Imagine what the reader will want to know particularly taking into consideration your final diagnosis.
- Problem list and overall case assessment
    - This should be a brief summary of your initial thoughts including the differentials you think are most likely in light of the information you have given so far. This information then allows you to justify the diagnostic pathway you have chosen for this particular animal.
- Investigation
    - Within this section there needs to be some rationalisation of why certain diagnostic tests were chosen. Avoid testing for disorders/diseases that were not considered in your problem-based assessment or differential diagnosis.
    - The examiner is looking for a safe and logical approach to investigation.
    - All relevant results should be listed in the main body of the report although full results may be included in an appendix for the examiners information.
    - Images may be included in this section only if they add to the understanding of the case.
- Diagnosis
    - This will be one short sentence, for example “hypoadrenocorticism complicated by hypovolaemia of gastrointestinal haemorrhage, with regenerative anaemia”. The diagnosis must be logical and unequivocal unless there is some discussion adequately justifying any limitations later in the report.
- Treatment
    - This section should include limited details of treatment.
- Outcome and follow-up
    - Follow-up is an important aspect of clinical pathology investigation, to confirm the correct interpretation of the laboratory testing was made, and discussion of subsequent pathology testing is often appropriate.
- Discussion
    - The discussion does not need to make the largest part of the report.
    - The discussion should be pertinent and relate to observations relevant to the case, rather than being a review of the literature. Instead use your knowledge gained from research to justify and explain your clinical reasoning diagnosis. You may also use

available evidence to highlight how your case was similar to or different from reported cases with the same diagnosis.

  - Some reflective component is expected even if the case outcome was excellent, there are usually lessons to be learned somewhere. What could have been done differently; were there any limitations of investigation or management, was there any way you could have managed the resources for testing more efficiently?? Reflection cannot excuse a serious mistake in case management but can highlight how minor errors would be improved upon next time if they have occurred.
  - For C modules we expect you to have read a range of material when researching your case such as relevant textbooks, review articles, case series and research articles from peer reviewed journals.

- References
  - These should be properly cited in the text, in accordance with the style in the Journal of Small Animal Practice (JSAP) or similar. Avoided listing references that were not cited in the text or vice versa.
  - We recommend using Harvard referencing as described by the Anglia-Ruskin University (http://libweb.anglia.ac.uk/referencing/harvard.htm).
  - You will find it very helpful to use a program such as Endnote® or Reference manager® to organise your references.
- Appendices
  - You may include appendices but please note that the examiners are not obliged to read them (so please don't include essential case information in the appendix only).
  - Full 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.

The **word limit** is **1,500 words** per case 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 strictly adhered to and reports that exceed it will be returned unmarked.

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.

Instructions for submitting work

Each piece of work you submit must be anonymous and should be uploaded to Learn for marking;

The case diary should preferably be written in Excel and the commentaries, synopsis and case reports should be in Word. Please ensure that the beginning of each piece of work includes:

1. your student number
2. module name
3. title of work
4. word count (excluding the above, tables, photo titles and references)

Recommended reading list

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 you 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 you feel a particular favourite is missing - feel free to use the Learn discussion board to pass on additional suggestions to other candidates.

Textbooks:

- Valenciano AC, Cowell RL: Cowell and Tyler's Diagnostic Cytology and Hematology of the Dog and Cat. Elsevier. *Good for both haematology and cytology – useful flowcharts for cytological diagnoses.*
- Raskin RE, Meyer DM: Canine and Feline Cytology, A Color Atlas and Interpretation Guide. Saunders. *Excellent cytology reference.*
- Harvey JW: Veterinary Hematology: A Diagnostic Guide and Color Atlas. Saunders. *Excellent haematology atlas for domestic species, lots of pictures and logical layout.*
- Thrall MA, Weiser G, Allison R, Campbell TW: Veterinary Hematology and Biochemistry. Wiley-Blackwell. *Includes exotic haematology and biochemistry.*
- Weiss DJ, Wardrop KJ: Schalm's Veterinary Hematology. Wiley-Blackwell. *Very detailed haematology text.*
- Stockham SL, Scott MA: Fundamentals of Veterinary Clinical Pathology. Blackwell. *Very detailed, but well-structured in bulletpoint format, so good to read specific topics. Focuses on biochemistry and haematology*
- Latimer KS, Mahaffey EA, Prasse KW: Duncan & Prasse's Veterinary Laboratory Medicine: Clinical Pathology. Wiley-Blackwell. *Basic level clinical pathology text.*
- Villiers E., Ristic J, Blackwood L: BSAVA Manual of Canine and Feline Clinical Pathology. BSAVA. *A very accessible text for the practicing veterinarian.*

- Cowell RL, Tyler RD: Diagnostic Cytology and Hematology of the Horse. Mosby. *Now slightly outdated but still valuable for equine cases*
- Walton RM: Equine clinical pathology. Wiley-Blackwell. *Includes haematology, biochemistry and BAL, CSF, and fluid cytology.*
- Campbell TW, Ellis CK: Avian and Exotic Animal Hematology and Cytology. Blackwell. *For the exotic enthusiast.*

Journals:

Journals regularly publishing high-quality papers in the field of clinical pathology include:

- Veterinary Clinical Pathology
- Journal of Veterinary Internal Medicine
- Journal of Small Animal Practice
- Journal of American Veterinary Association
- Vet Clinics of North America
    - Of specific interest are the clinical pathology/haematology focused issues for small animal practice:
        - November 2013, Vol 43: Clinical pathology and diagnostic testing
        - January 2012, Vol 42: Hematology

Best resources for searching the literature:

- www.ncbi.nlm.nih.gov/pubmed/
- http://scholar.google.co.uk/ This is almost as good if not better than pubmed; it doesn't organize by date as well but will come up with things that aren't included in pubmed that can sometimes be relevant.