



THE UNIVERSITY OF
MELBOURNE

FACULTY OF
VETERINARY &
AGRICULTURAL
SCIENCES

VETERINARY BIOSCIENCE: CARDIOVASCULAR SYSTEM



CASE STUDY

LARRY LOSES HEART

VETS30014
VETS90124

HOW TO COMPLETE A CASE STUDY

You will need to work through each case study in your group.

- Save a copy of this PDF document on the Desktop of your computer before you start work.
- You will be working together as a group to complete the workshop.
- You need to complete each activity sequentially, in the order that they are presented in this file. Do not jump ahead.
- This file gives you detailed instructions for completing each activity. Ask your tutor if you have any questions.
- For some activities, you will be asked to record your answers to the questions by typing them into this file. You should save this PDF file each time you complete one of these questions, to make sure that your work does not get lost.

GUIDELINES FOR EFFECTIVE GROUP WORK

Your group will work at its best when everyone feels comfortable and “safe” to contribute to discussion. Here are a few suggestions that might help promote a safe and effective group work environment:

- Ensure that you all know one another’s names- and that you use them during your conversations.
- Effective listening is a key to effective group work. Respectful listening enhances a positive group dynamic, and creates a space where it is safe for all to contribute.
- Taking time to discuss is really important- discussing involves questioning and responding, reviewing and reflecting, sharing understanding. This is where deep learning occurs. It can often be greatly enhanced by visualisation- by sharing of ideas, summaries and processes on your white board and by collective rephrasing and reframing of ideas.
- Sharing of tasks and responsibilities is also important in group work. Perhaps make a roster and each week have a different group member take responsibility for the keyboard, and for completing your interactive pdf.

INSTRUCTIONS

Enter each group member's name, land email address below. After you have completed working through this document, save a copy and follow the instructions at the end of the document to share it with your group via the LMS or email.

GROUP NUMBER

Name	Email Address

INTRODUCTION



You are working in the equine department of a mixed veterinary practice in country NSW.

One morning Bill Hodges the owner of “Larry”, a 2 year old Standard bred colt calls you up. Larry is in training to become a “pacer” so he can take part in harness racing. Harness racing is a form of horse racing in which horses race at a specific gait (trot or pace) around a circular track, pulling a two-wheeled cart known as a “sulky”.

Bill reports that a few days previously he was out on the training track with Larry when a piece of white paper blew across the track in front of them. Larry had reared up in his harness and since that time Larry seems to have lost his ability to perform at a peak level.

“He couldn’t run fast enough to get hot!”, says Bill. “Can you come out and have a look at him?”

QUESTION 1

- List the **key information** about Larry below. Key information is all the information that may be relevant in assessing his current condition.
- Identify Larry's **main problem** and make a list of how it may be caused using a systematic approach. We will call each item on this list a **hypothesis**. For each hypothesis discuss how it may be causing the identified problem.
- What further information, which might be obtained from questioning the owner, will help you decide between your hypotheses? Discuss your reasoning behind each question.

HISTORY

Bill reports that he bought Larry about 12 months previously and has been actively training him for the last 6 months. During that time there have been no issues with lameness or poor performance. However, following the paper incident, there has been a fairly dramatic decline in his performance. When previously he had completed a distance of 1609m (one mile) in 2 minutes and 5 seconds, he was now taking 2 minutes and 20 seconds. Bill had checked Larry thoroughly after he had reared up, but had only found a few minor grazes and no sign of lameness.

QUESTION 2

- Summarize the additional information obtained from the history.
- Based upon this information refine your hypotheses – decide whether they are more likely, less likely or can be excluded. Provide an explanation for each change. Give a mechanism for any new hypothesis.
- What further information that you can obtain from a physical examination may help you refine your hypotheses?

PHYSICAL EXAMINATION

You perform a physical examination on Larry with the results recorded below.

Parameter	Findings	Normal
Body weight kg	489	
Temperature °C	37.1	36.9-38.3
Pulse	44 - irregular rhythm with variable strength pulse	28-40
Respiration	12	8-16
Mucous membrane colour	Pink	Pink
Capillary refill time s	1.5	<2
Thoracic examination	Irregular cardiac rate and rhythm. Variable intensity of heart sounds. S1, S2 and S3 heart sounds present but no S4.	S1 and S2 usually heard. Variable S3 and S4.
Abdominal auscultation	NAD (no abnormalities detected)	Regular gut sounds including one ileocaecal valve sound every minute
Rectal examination	NAD	NAD

QUIZ 1

Click back to the LMS and attempt **Quiz 1** before continuing.

QUESTION 3

- Are there any terms that you do not understand? If so, research their meaning and record these below.
- Summarize the additional information obtained from the physical examination.
- What physiological factors could contribute to the intensity of the heart sounds? Discuss these and make a list in your wiki
- In what circumstances might you hear louder heart sounds?
- What physiological factors determine the strength of the pulse that is palpated on clinical examination?
- What explanations can you provide for the variable intensity of both Larry's heart sounds and pulse?
- Based upon this information refine your hypotheses – decide whether they are more likely, less likely or can be excluded and explain why.
- What further tests could be performed to differentiate between these diagnoses?
- At this stage, draw a mechanism on the white board for your most likely hypothesis.

DIAGNOSTIC TESTING

In view of the abnormal heart rhythm detected on auscultation you decide to perform an electrocardiogram (ecg) on Larry in order to explore the electrical events taking place in his heart. Click the link below to view a video on obtaining and reading an equine ECG:

<https://vimeo.com/734588937/80b0c23c0d>

Copy-paste the link below into your browser to view Larry's Lead 2 ECG trace:

https://lms.vet.unimelb.edu.au/Case%20Studies/Larry%20Loses%20Heart/ECG_page9.jpg

QUESTION 4

- Use the questions below to help you interpret the trace. Paper speed (x axis) is 25mm/s i.e. each grid box represents 0.04s and each vertical (y axis) grid box represents 0.1mV).
 1. Determine heart rate: is it increased, decreased or normal?
 2. Assess heart rhythm: is it regular or irregular (there should be less than 10% variation in the R-R intervals).
 3. Check for P waves and whether every P wave is followed by a QRS complex.
 4. Check that every QRS complex is preceded by a P wave.
 5. Check complexes: are waveforms normal or abnormal?
- What is your ecg assessment and diagnosis?

DIAGNOSIS

The ecg findings are indicative of atrial fibrillation. In atrial fibrillation there are no definable P waves on the ecg. There is no coordinated wave of atrial contraction and impulses reach the atrioventricular node in a random fashion.

QUESTION 5

- What effect will this have on atrial function?
- What effect will this have on ventricular function?
- What mechanisms cause cardiac output (and thus performance) to fall when atrial fibrillation is present in a horse?

QUIZ 2

Click back to the LMS and attempt **Quiz 2** before continuing.

LATER THAT NIGHT

Later that evening you are “on call” for the whole practice. Mrs Wilton telephones to say she is concerned about her 8 year old, male Great Dane, Horace who was recently diagnosed with dilated cardiomyopathy. He is currently medicated with pimobendan to improve his cardiac function and furosemide for his secondary pulmonary oedema. Mrs Wilton has noticed that he has slowed down considerably in the last few days and is now so concerned about him that she would like him checked this evening.

Your examination reveals a rapid and irregular heart rate with pulse deficits (lack of a pulse for each beat). You decide to perform an ecg. Click the link below to view the lead II trace.

https://lms.vet.unimelb.edu.au/Case%20Studies/Larry%20Loses%20Heart/ECG_page11.jpg

QUIZ 3

Click back to the LMS and attempt **Quiz 3** before continuing.

QUESTION 6

What is meant by the term pulse deficit? Explain in terms of cardiovascular function how a pulse deficit might occur.

QUESTION 7

- Use the questions below to help you assess Horace's ECG trace. Note that the paper speed is 50mm/s i.e. each grid box represents 0.02s and each vertical (y axis) grid box represents 0.1mV).
 1. Determine heart rate: is it increased, decreased or normal?
 2. Assess heart rhythm: is it regular or irregular (there should be less than 10% variation in the R-R intervals) .
 3. Check for P waves and whether every P wave is followed by a QRS complex.
 4. Check that every QRS complex is preceded by a P wave.
 5. Check complexes: are waveforms normal or abnormal?
 6. Measure the following if possible and compare them with normal values for a large breed dog: P wave height (<0.4mV), P wave width (<0.04s), P-R interval (0.06-0.13s), R wave height (<3.0mV), QRS duration (<0.06s), QT interval (0.15-0.25s).
- Summarise your interpretation of Horace's ECG trace. What would you tell Mrs Wilton about the reason for the deterioration in Horace's condition?
- Do you think the abnormality of rhythm that has developed in Horace is more serious than Larry's arrhythmia? If so, why is this the case?

TREATMENT

Both Horace and Larry have atrial fibrillation. Atrial fibrillation tends to manifest itself differently in dogs and horses. In horses it often develops spontaneously with no evidence of cardiac disease. It is thought to be perpetuated by the large size of the equine heart and the high degree of vagal tone present. In dogs atrial fibrillation is usually associated with underlying cardiac disease that causes left atrial enlargement.

In horses the goal of treatment is to restore normal sinus rhythm. Provided there is no underlying cardiac disease and the atrial fibrillation has been present for less than three months, this is frequently achieved with the use of quinidine. Quinidine is administered orally by stomach tube every 2 hours at a dose of 20mg/kg (10 grams per horse) until either normal sinus rhythm is restored or toxic side effects are seen (anorexia, depression, incoordination and colic). Most horses cannot tolerate more than four treatments every two hours before toxic signs develop, and continuous ECG monitoring during cardioversion should be performed. Conversion is often achieved with quinidine, but the likelihood of a horse getting back into atrial fibrillation is much greater if it has been going on for more than three months.

In dogs the goal of treatment is to slow the transmission of impulses through the atrio-ventricular node in order to allow more efficient ventricular filling and thus enhance cardiac output. Unlike the horse, it is generally not possible to restore normal sinus rhythm in dogs because of the underlying cardiac pathology. In dogs, digoxin is generally used as a first line of treatment, although calcium channel blockers and beta blockers are sometimes used. Digoxin works as an anti arrhythmic by slowing conduction through the AV node.

QUESTION 8

- What are the theories for the generation of dysrhythmias and how may these be applicable in the case of atrial fibrillation?

QUIZ 4

Click back to the LMS and attempt **Quiz 4** before continuing.

PROGRESS

Larry is given an initial dose of 10g of quinidine but lead II ecg indicates that atrial fibrillation is still present. After two more doses of 10g of quinidine, auscultation of Larry's chest suggests that he is now in normal sinus rhythm. Click the link below to view the ecg at this time (lead II trace).

https://lms.vet.unimelb.edu.au/Case%20Studies/Larry%20Loses%20Heart/ECG_page14.jpg

QUESTION 9

- Using the guide to interpretation of an ECG trace provided below, decide whether Larry is now in normal sinus rhythm or whether further doses of quinidine are required. Paper speed (x axis) is 25mm/s i.e. each grid box represents 0.04s and each vertical (y axis) grid box represents 0.1mV).
 1. Determine heart rate: is it increased, decreased or normal?
 2. Assess heart rhythm: is it regular or irregular (there should be less than 10% variation in the R-R intervals)
 3. Check for P waves and whether every P wave is followed by a QRS complex.
 4. Check that every QRS complex is preceded by a P wave.
 5. Check complexes: are waveforms normal or abnormal?
- Does Larry's ECG trace show normal sinus rhythm? Has Larry's heart rate changed?

OUTCOME

Larry responded well to the quinidine and was discharged the following day in normal sinus rhythm. Larry was rested for 3 months and was then put back to work and slowly improved his times to where they were prior to his episode of atrial fibrillation. Unfortunately, this did not translate into any degree of success on the racing track!

Horace did not fare so well. He was started on oral digoxin in conjunction with the pimobendan and furosemide. Although there was some reduction in his heart rate as a consequence of this, he continued to deteriorate and was euthanased three weeks later.

REFERENCES

Glazier B. (1987) Clinical aspects of equine cardiology. In Practice 9: 98 - 104

Menzies-Gow N. (2001) ECG interpretation in the horse. In Practice 23: 454 - 459

UPLOAD INSTRUCTIONS

You have completed the case study. To share the completed document with your group:

1. Save this file to the Desktop
2. Share the files with your group via email.