Developing On-line Case Studies for Teaching Avian Medicine

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Introduction

The teaching of avian medicine in veterinary schools is complicated by increasing class sizes, the limited time available in the undergraduate curriculum and the need for postgraduate or self direct extramural training. In developing courses in avian medicine, the use of on-line components such as discussion boards, on-line tutorials and case studies are becoming important teaching tools for both undergraduate and post-graduate teaching. Using templates developed for other on-line veterinary courses we are developing a series of case studies in avian medicine to allow students to apply the knowledge taught to the students in lectures and course notes in a real case scenario.

It is difficult to capture the complexity of a real case with on-line material but the use of video and digital images can be used to give a feel for real case material. Feedback on the students' choices are necessary for learning and this means that developing even a simple case into a learning experience is very labour intensive. A combination of multiple choice questions, true and false responses, ranking and text matching questions can be used. In addition, using a point and click method to highlight the correct area on a radiograph or a picture can be used to assess diagnostic skills such as radiographic interpretation.

In this presentation I will run through a case study - the notes below document the various processes and responses that are required to produce the final result. It is presented here for peer review and critical comment.

Case Construction area

Patient's name: Goldies lorikeet (*Tricholossus goldiei*) "Zip"
Author's name: Brett Gartrell

Page A

History Page

Signalment
5 year old female Goldies lorikeet

History
Your client is a breeder of exotic lorikeets and a manufacturer of a proprietary lorikeet diet. This bird is a Goldies lorikeet, a breeding female from a bonded pair. There are only 10 Goldies lorikeets in New Zealand so the value of the bird is high and estimated at $10,000. The owner has had this pair for the last 18 months. The birds have not bred for your client but the previous owner claims the pair bred every year and raised 3-4 chicks per year.

The birds are fed the client's lorikeet dry mix, which is based on a recipe from a prominent Australian aviculturist that has proven itself in many breeding lorikeets before. They also are supplemented with fresh fruit daily and honey-water.

In the last two weeks the pair has regularly engaged in nestbox inspection. The birds have been eating well and there has been no change to the droppings. However, for the last three days the female lorikeet has been fluffed up and quiter than usual.

Page B
Physical Examination
Distance examination
The bird is bright, alert and responsive. Examine the video clip here before moving on to the close physical examination.

(Insert video clip Goldies 1 here)

Question: What is the single most striking feature of the distance exam? Choose the most important clinical finding.

Multiple choice option	**comment if picked**	**Score if picked**	**comment if not picked**	**Score if not picked**
Beak overgrowth	No, the beak is normal for this species	-1	The beak is normal for this species	0
Dropped wings	No, the wing carriage is normal	-1	The wing carriage is normal	0
Respiratory effort	Yes, there is marked exaggeration of the respiratory pattern.	1	There is marked exaggeration of the respiratory pattern.	-1
Tail bob	A tail bob is not reliably present in short-tailed species. The exaggerated chest excursions are the most reliable feature here.	0	A tail bob is not reliably present in short-tailed species. The exaggerated chest excursions are the most reliable feature here.	0
Stained ventral covert feathers	There is staining of these feathers but it is not the most important feature of the distance exam	0	There is staining of these feathers but it is not the most important feature of the distance exam	0
Ceiling score	**1**	**Floor score**	**-1**	

Page C

Physical examination
Physical exam
Questions: How will the findings of the distance exam affect your close physical examination? (True/False)

No changes to physical exam. The practitioner can proceed with their normal examination routine serene in mind and spirit.

Comment if true picked	Score if true picked
FALSE. The degree of respiratory effort indicates severe respiratory compromise. The stress of prolonged handling may be enough to kill this patient	-1
Comment if false picked	**Score if false picked**
CORRECT. The degree of respiratory effort indicates severe respiratory compromise and the examination will have to be short and focussed	1

Give the owners a guarded prognosis prior to handling for examination and diagnostics

Comment if true picked	Score if true picked
CORRECT. Owners are much more likely to be forgiving that a bird has died in your hands if you spend a few moments prior to handling discussing the seriousness of the clinical signs	1
Comment if false picked	**Score if false picked**
WRONG. The degree of respiratory effort indicates severe respiratory compromise. The stress of prolonged handling may be enough to kill this patient, particularly as it is an aviary bird and not used to human contact.	-1

No physical examination should be carried out

Comment if true picked	Score if true picked
WRONG. Despite the risks, skipping the physical examination is likely to result in misdiagnosis. We do not have enough information to initiate therapy yet beyond oxygen supplementation.	-1
Comment if false picked	**Score if false picked**
CORRECT. Despite the risks, skipping the physical examination is likely to result in misdiagnosis.	1

Light general anaesthesia with isoflurane and oxygen may aid the physical examination

Comment if true picked	Score if true picked
CORRECT. Most birds with respiratory distress breathe more easily under a light general anaesthesia which will allow a longer time for physical examination, collection of diagnostic samples and initial treatment with minimal stress to the bird.	1
Comment if false picked	**Score if false picked**
INCORRECT (in my opinion). Most birds with respiratory distress breathe more easily under a light general anaesthesia which will allow a longer time for physical examination, collection of diagnostic samples and initial treatment with minimal stress to the bird. However, there is a risk of increased respiratory depression resulting in respiratory or cardiac failure.	0

This bird should be manually restrained for the shortest possible period and the examination aborted if worsening signs of distress

Comment if true picked	**Score if true picked**
CORRECT. Signs that might indicate the bird is not coping with the exam include open-mouth breathing, sudden stiffening or slackening in muscle tone, loss of response to environment (ie she stops trying to bite you), and unusual vocalisations.	1
Comment if false picked	**Score if false picked**
DEAD WRONG. Signs that might indicate the bird is not coping with the exam include open-mouth breathing, sudden stiffening or slackening in muscle tone, loss of response to environment (ie she stops trying to bite you), and unusual vocalisations.	-1

Ceiling score	**5**	**Floor score**	**0**

Page D
Physical examination
The bird weighs 68g. The bird is in fair to poor pectoral muscle condition (3/9). The bird is bright, alert and responsive but resents your handling and tries to bite you. The feathers on the ventral abdomen are damaged by stripping of the vanes. The feathers around the vent are matted with yellow urates and dried faeces, but the vent is still patent. The abdomen is markedly swollen, and the swelling is soft and of fluid consistency on digital palpation. No abdominal masses can be palpated. The eyes are bright, round and prominent.

No other significant findings on physical examination. The faeces present in the cage consistent of large amounts of urine, yellow urates and a liquid brown faecal component.

Problem Identification Page

What is your initial problem list? Select as many choices as needed

Multiple choice option	comment if picked	Score if picked	comment if not picked	Score if not picked
Abdominal enlargement	CORRECT.	1	You really should have picked this one.	-1
Anorexia	WRONG. Both the history and the presence of a faecal component in the droppings suggest this bird is still eating despite the poor body condition.	-1	Both the history and the presence of a faecal component in the droppings suggest this bird is still eating despite the poor body condition.	0
Behavioural feather picking	WRONG. There is not enough information to precisely define the cause of the feather stripping on the abdomen.	0	There is not enough information to precisely define the cause of the feather stripping on the abdomen.	0
Biliverdinuria	WRONG. Biliverdin in the urates turns them lime green. Yellow urates generally indicates catabolism of muscle mass or starvation.	0	Biliverdin in the urates turns them lime green. Yellow urates generally indicates catabolism of muscle mass or starvation.	1
Dehydration	WRONG. One of the key indicators of dedration in birds is a sunken, dull eye. This birds eyes are bright and prominent.	0	One of the key indicators of dedration in birds is a sunken, dull eye. This birds eyes are bright and prominent.	0
Depression	POSSIBLE. The bird is described as bright, alert and responsive but this could be the preservation reflex at work.	1	POSSIBLE. The bird is described as bright, alert and responsive but this could be the preservation reflex at work.	0
Diarrhoea	POSSIBLE. The staining of the vent feathers may be due to diarrhoea or the abdominal enlargement causing an alteration in the angle of the vent. Difficult to assess diarrhoea in a lorikeet as liquid droppings are dietary related and normal.	1	POSSIBLE. The staining of the vent feathers may be due to diarrhoea or the abdominal enlargement causing an alteration in the angle of the vent. Difficult to assess diarrhoea in a lorikeet as liquid droppings are	0

			dietary related and normal.	
Faecal staining around vent	CORRECT. This is more precise than stating it is due to diarrhoea. The staining of the vent feathers may be due to diarrhoea or the abdominal enlargement causing an alteration in the angle of the vent.	1	This is more precise than stating the problem is due to diarrhoea. The staining of the vent feathers may be due to diarrhoea or the abdominal enlargement causing an alteration in the angle of the vent.	0
Feather picking on ventral abdomen	CORRECT. Many birds will mutilate feathers over areas of discomfort or pain.	1	The stripping of the vanes suggest the feather damage is self-inflicted.	0
Muscle wasting	CORRECT. The poor body condition and the presence of yellow urates all suggest catabolism of body stores.	1	You really should have picked this one.	0
Pneumonia	WRONG. The presence of respiratory distress does not necessarily mean respiratory disease in birds.	-1	The presence of respiratory distress does not necessarily mean respiratory disease in birds.	0
Polyuria	POSSIBLE. Large amounts of urine are normal in lorikeets fed liquid diets and are also seen in normal birds after the stress of transport. Diagnosing polyuria in lorikeets is extremely difficult	0	POSSIBLE. Large amounts of urine are normal in lorikeets fed liquid diets and are also seen in normal birds after the stress of transport. Diagnosing polyuria in lorikeets is extremely difficult	0
Respiratory distress	CORRECT. Well, duh….	1	WRONG. Really very badly wrong.	-1
Yellow urates	CORRECT. The presence of yellow urates is seen with catabolism of muscle tissue, starvation or in cases of internal haemorrhage.	1	The presence of yellow urates is seen with catabolism of muscle tissue, starvation or in cases of internal haemorrhage.	0
Ceiling score	**8**	**Floor score**	**0**	

Page E

Experienced Clinician's Problem List Page

The problem orientated approach demands that you generate a differential list for all the problems that have been identified. These are the most critical problems that have been identified for this Goldies lorikeet

Abdominal enlargement
Respiratory distress
Catabolism (muscle wasting/yellow urates)

Catabolism has a very broad differential diagnosis so let's focus on the main differential diagnoses for abdominal enlargement and respiratory distress. While respiratory distress has a large number of differential diagnoses, lets focus for the purposes of this exercise on causes of respiratory distress associated with abdominal enlargement. It is possible to have an unconnected cause of the respiratory distress but let's give that possibility a lower priority for now.

The possibility of diarrhoea, polyuria and feather picking are also important and in a clinical situation these would need to be ruled in or out. For the purposes of this exercise however, lets assume that the diarrhoea and polyuria are dietary in origin in this lorikeet. The feather picking will be considered later.

Write down on your piece of paper the main differential diagnoses for abdominal enlargement and respiratory distress. Once you have finished, click the Continue button at the bottom of the page.

Page F

Differential Diagnosis Page

What are your initial differential diagnoses for each of these problems? Select as many as are appropriate.

Problem 1
Abdominal enlargement with fluid distension

Multiple choice option	comment if picked	Score if picked	comment if not picked	Score if not picked
Ascites	CORRECT. This is one of our main differentials. Ascites occurs within the peritoneal or cardio-hepatic air sac of the birds and causes distension of these.	1	Ascites occurs within the peritoneal or cardio-hepatic air sac of the birds and causes distension of these.	-1
Bladder obstruction	WRONG. No bladder in birds.	-1	No bladder in birds.	0
Cloacal distension	CORRECT. This may be neurological from spinal trauma or obstructive from vent occlusion or cloacoliths. Urates, faeces and urine can distend the cloaca.	1	Urates, faeces and urine can distend the cloaca. This may be neurological from spinal trauma or obstructive from vent occlusion or cloacoliths.	0
Coelomic granulomas	WRONG. These are not associated with fluid production in birds.	-1	These are not associated with fluid production in birds.	0
Cystic ovarian or uterine disease	CORRECT. Cystic ovarian disease is common in female birds and results in large fluid filled cysts on the ovary. There are also rare cases of cystic uterine disease in birds.	1	Cystic ovarian disease is common in female birds and results in large fluid filled cysts on the ovary. There are also rare cases of cystic uterine disease in birds.	0
Egg in oviduct	A hard mass is usually palpable within the abdomen. A soft shelled egg will feel more like a soft tissue mass.	0	A hard mass is usually palpable within the abdomen. A soft shelled egg will feel more like a soft tissue mass.	0
GI dilatation	CORRECT. Chronic enteritis will sometimes result in enlarged fluid filled intestinal loops.	1	Chronic enteritis will sometimes result in enlarged fluid filled intestinal loops.	0
Hepatomegaly	Hepatomegaly on its own will not result in fluid distension of the abdomen unless associated with ascites	0	Hepatomegaly on its own will not result in fluid distension of the abdomen unless associated with ascites	0
Herniation	WRONG. Herniation will result in abdominal enlargement but is not associated with fluid distension.	-1	Herniation will result in abdominal enlargement but is not associated with fluid distension.	0

Neoplasia	Most abdominal neoplasms result in soft tissue masses rather than fluid, however abdominal carcinomas can result in ascites	0	Most abdominal neoplasms result in soft tissue masses rather than fluid, however abdominal carcinomas can result in ascites	0
Obesity	Fat stores in the abdomen and subcutaneously can give the appearance of abdominal enlargement but are unlikely to feel like fluid in the abdomen	0	Fat stores in the abdomen and subcutaneously can give the appearance of abdominal enlargement but are unlikely to feel like fluid in the abdomen	0
Oviduct impaction	WRONG. In this condition, the oviduct is palpable as a soft tissue mass.	-1	In this condition, the oviduct is palpable as a soft tissue mass.	0
Renomegaly	WRONG. Renal enlargement is not associated with fluid distension in birds.	-1	Renal enlargement is not associated with fluid distension in birds.	0
Splenomegaly	WRONG. Splenic enlargement or disease is not associated with fluid distension in birds.	-1	Splenic enlargement or disease is not associated with fluid distension in birds.	0
Yolk-related peritonitis	CORRECT. This bird has been showing interest in the nest box and this is one of our main differentials. The presence of yolk in the peritoneum incites a marked inflammatory response. If no bacterial colonisation, then most cases will spontaneously resolve over several days. If infected then life-threatening septic peritonitis occurs.	1	This bird has been showing interest in the nest box and this is one of our main differentials. The presence of yolk in the peritoneum incites a marked inflammatory response. If no bacterial colonisation, then most cases will spontaneously resolve over several days. If infected then life-threatening septic peritonitis occurs.	-1
Ceiling score	**5**	**Floor score**	**0**	

Problem 2
Respiratory distress associated with abdominal enlargement

Multiple choice option	comment if picked	Score if picked	comment if not picked	Score if not picked
Air sacculitis	WRONG. This will cause respiratory distress but is not associated with abdominal enlargement	-1	This will cause respiratory distress but is not associated with abdominal enlargement	0
Ascites	CORRECT. This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Cardiac disease	CORRECT. This will cause abdominal distension through ascites and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension through ascites and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Chlamydiosis	CORRECT. This will cause abdominal distension through hepatomegaly and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension through hepatomegaly and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Cloacal distension	CORRECT. This will cause abdominal distension in severe cases and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension in severe cases and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Cystic ovarian or uterine disease	CORRECT. This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Egg binding	CORRECT. This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Egg in oviduct	CORRECT. This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
GI dilatation	WRONG. Even when severe this is unlikely to result in respiratory distress.	-1	Even when severe this is unlikely to result in respiratory distress.	0

Hepatomegaly	CORRECT. This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Herniation	WRONG. Even when severe this is unlikely to result in respiratory distress.	-1	Even when severe this is unlikely to result in respiratory distress.	0
Neoplasia	CORRECT. This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Obesity	CORRECT. This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Oviduct impaction	CORRECT. This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Pneumonia	WRONG. The lungs of birds are relatively fixed compared to mammals and there is no pleura so there is no association between pneumonia and abdominal enlargement	-1	The lungs of birds are relatively fixed compared to mammals and there is no pleura so there is no association between pneumonia and abdominal enlargement	0
Renomegaly	WRONG. Even when severe this is unlikely to result in respiratory distress.	-1	Even when severe this is unlikely to result in respiratory distress.	0
Splenomegaly	WRONG. Even when severe this is unlikely to result in respiratory distress.	-1	Even when severe this is unlikely to result in respiratory distress.	0
Tracheal foreign body	WRONG. This will cause respiratory distress but is not associated with abdominal enlargement.	-1	This will cause respiratory distress but is not associated with abdominal enlargement.	0
Upper respiratory tract disease	WRONG. This will cause respiratory distress but is not associated with abdominal enlargement.	-1	This will cause respiratory distress but is not associated with abdominal enlargement	0
Yolk-related peritonitis	CORRECT. This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	1	This will cause abdominal distension and reduce the air sac and lung capacity available to the bird resulting in respiratory distress.	-1
Ceiling score	**10**	**Floor score**	**0**	

Page G

Investigation or Treatment Plan Page

What investigation(s) or therapeutic interventions would you perform first? Select as many as are appropriate, remembering that in reality these are things you would try to perform on the first or second day of hospitalisation.

Multiple choice option	Results available ?	comment if picked	Score if picked	comment if not picked	Score if not picked
Abdominocentesis	Yes	Excellent choice! You really need to know what the fluid is you are dealing with and abdominocentesis can be carried out quickly with minimal risk to the bird and will relieve some of the respiratory distress. The fluid should be submitted for cytology and culture.	3	You really need to know what the fluid is you are dealing with and abdominocentesis can be carried out quickly with minimal risk to the bird and will relieve some of the respiratory distress. The fluid should be submitted for cytology and culture.	-3
Ultrasound	No	This would not be an immediate choice of diagnostics for me because it will take a prolonged period of handling or anaesthesia in a respiratory compromised patient. However, the abdominal fluid will allow an excellent view of the coelomic structures and it may be diagnostically useful when the patient is more stable.	0	This would not be an immediate choice of diagnostics for me because it will take a prolonged period of handling or anaesthesia in a respiratory compromised patient. However, the abdominal fluid will allow an excellent view of the coelomic structures and it may be diagnostically useful when the patient is more stable.	0
Exploratory laparotomy	No	All guts and glory for you! I don't think you have enough information yet to justify a high risk surgery for this bird.	-3	Not enough information yet to justify a high risk surgery for this bird.	0
Haematology	Yes	Good choice. This may help define the nature and chronicity of the problem.	1	This may help define the nature and chronicity of the problem and should be a standard choice for most of your cases where finances allow.	-1
Serum biochemistry	Yes	Good choice. This may help define the nature and organ	1	This may help define the nature and organ	-1

		system involved in the problem.		system involved in the problem and should be a standard choice for most of your cases where finances allow.	
Radiography	No	This would not be an immediate choice of diagnostics for me because it will take a prolonged period of handling or anaesthesia in a respiratory compromised patient. The diagnostic yield from a radiograph is likely to be low unless the abdominal fluid is drained completely as it will white out any detail in this area.	-1	This would not be an immediate choice of diagnostics for me because it will take a prolonged period of handling or anaesthesia in a respiratory compromised patient. The diagnostic yield from a radiograph is likely to be low unless the abdominal fluid is drained completely as it will white out any detail in this area.	0
Faecal analysis	Yes	Low impact diagnostic technique that should be standard choice for most patients.	1	Low impact diagnostic technique that should be standard choice for most patients.	0
Urinalysis	No	Urinalysis in birds is complicated by the contamination with faeces and urates. Urine specific gravity is meaningless in birds due to presence of reptilian nephrons and the retrograde absorption of urine in the rectum. Presence of inflammatory casts in urine sediment is the only diagnostically valuable information.	0	Urinalysis in birds is complicated by the contamination with faeces and urates. Urine specific gravity is meaningless in birds due to presence of reptilian nephrons and the retrograde absorption of urine in the rectum. Presence of inflammatory casts in urine sediment is the only diagnostically valuable information.	0
Crop wash	No	High risk technique in a respiratory compromised patient with little chance of results influencing the course of this case.	-1	High risk technique in a respiratory compromised patient with little chance of results influencing the course of this case.	0
Laparoscopy	No	Endoscopy is contra-indicated in this patient as puncturing the already distended peritoneum will result in fluid leakage into the lungs and air sacs. The fluid distension will prevent visualisation of the coelomic sttructures. You have killed your patient for nothing!	-3	Endoscopy is contra-indicated in this patient as puncturing the already distended peritoneum will result in fluid leakage into the lungs and air sacs.	1
Chlamydia	Yes	Good choice. Its public	1	Its public health	-1

antigen testing		health importance make this an essential for any patient with respiratory distress.		importance make this an essential test for any patient with respiratory distress	
Ceiling score		**7**	**Floor score**		**0**

Page H

Experienced Clinician's Plan Page

An experienced clinician working through the Goldies lorikeet case, elected to perform the following diagnostic tests. Please examine the results.

Selected Tests or Therapeutic Options
Haematology
Serum biochemistry
Faecal analysis by direct smear and zinc sulfate flotation.
Abdominocentesis for cytology and culture
Chlamydia antigen (Clearview test)

Faecal analysis

~90% gram positive bacilli, ~10% gram negative bacilli. Large numbers of non-budding yeasts present. Occasional sloughed enterocytes. No inflammatory cells present. No evidence of motile protozoa on direct smear, or parasite eggs on faecal flotation.

Haematology and serum biochemistry

Hematology			**Units**	**Reference range**
HCT	0.39		L/L	0.35-0.55
WBC	11.7		x 10^9 /L	3-15
	Diff %	Abs ($x10^9$)		
Heterophils	83	12.2		
Lymphocytes	16	2.4		
Monocytes	1	0.1		
Total protein	49		g/L	22-50
Serum biochemistry				
Uric acid	346		mmol/L	0-600
CK	158		IU/L	120-875
AST	466		IU/L	100-350
GGT	8		U/L	0-5
Total protein	47		g/L	22-50
Albumin	27		g/L	12-20
Globulin	22		g/L	10-20
A/G ratio	1.4			1.4-3.3
Calcium	2.45		mmol/L	2.1-2.6
Glucose	12.2		mmol/L	11-25
Sodium	142		mmol/L	139-159
Potassium	3.6		mmol/L	2.2-3.7
Chloride	100		mmol/L	95-144
Bile acids	183		mmol/L	20-70

Abdominocentesis
A dark yellow, clear fluid was presented. The nucleated cell count was 0.068 $x10^9$ g/L. The total solids was 31 g/L.

Cytospin examination: The background of the smear contains numerous erythrocytes in the absence of thrombocytes. Other cells included 66% heterophils, 16% lymphocytes and 18% mononuclear cells. Approximately half of the mononuclear cells were macrophages with cytoplasmic vacuolation.

Cultures revealed no growth after 48 hours.

Cytological diagnosis: Modified transudate

Chlamydia antigen (Clearview test)
Negative on combined choanal and cloacal swab

Before proceeding to the next page, carefully consider your updated problem list. This will include new problems or diagnoses generated by the tests you decided to perform. Remember that some of the previously identified problems can now be resolved into a diagnosis whereas other problems may have become redefined or linked to other problems.

Page I

Revised problem list Page

(pop-ups for these results on this page

Haematology
Serum biochemistry
Faecal analysis by direct smear and zinc sulfate flotation.
Abdominocentesis for cytology and culture

Based on the results available, what is your revised problem list?

Multiple choice option	comment if picked	Score if picked	comment if not picked	Score if not picked
Ascites	Yes. The modified transudate from the peritoneal air sac is defined as ascites.	2	The modified transudate from the peritoneal air sac is defined as ascites.	-1
Cardiac disease	This is a possible differential diagnosis for the modified transudate but we do not have enough information to include it on the problem list yet.	0	This is a possible differential diagnosis for the modified transudate but we do not have enough information to include it on the problem list yet.	0
Cloacal distension	No, the abdominocentesis is not typical of cloacal distension given the absence of faeces or urates.	-1	The abdominocentesis is not typical of cloacal distension given the absence of faeces or urates.	0
Cystic ovarian disease	This is a possible differential diagnosis for the modified transudate but we do not have enough information to include it on the problem list yet.	0	This is a possible differential diagnosis for the modified transudate but we do not have enough information to include it on the problem list yet.	0
Enteritis, bacterial	No, the faecal exam does not support a diagnosis of bacterial enteritis. The bacterial population on the Gram stain is typical of parrots	-1	The faecal exam does not support a diagnosis of bacterial enteritis. The bacterial population on the Gram stain is typical of parrots	0
Enteritis, fungal	No, the yeasts present in the faecal exam are not budding and therefore most likely to be dietary in origin.	-1	The yeasts present in the faecal exam are not budding and therefore most likely to be dietary in origin.	1
Hepatopathy	Yes, the mild elevations of AST and GGT suggest ongoing hepatocyte damage. The elevated bile acids suggests reduced hepatic function.	2	The mild elevations of AST and GGT suggest ongoing hepatocyte damage. The elevated bile acids suggests reduced hepatic function	-1
Heterophilia	No, there is no indication of this on the haemogram	-1	There is no indication of this on the haemogram	0

Leucocytosis	No, there is no indication of this on the haemogram	-1	There is no indication of this on the haemogram	0
Lymphopaenia	No, there is no indication of this on the haemogram	-1	There is no indication of this on the haemogram	0
Neoplasia	This is a possible differential diagnosis for the modified transudate but we do not have enough information to include it on the problem list yet.	0	This is a possible differential diagnosis for the modified transudate but we do not have enough information to include it on the problem list yet.	0
Porto-systemic shunt	The elevation of bile acids does suggest reduced enterohepatic circulation but does not indicate a shunt	0	The elevation of bile acids does suggest reduced enterohepatic circulation but does not indicate a shunt	0
Renal disease	No, the uric acid level, although a limited indicator of renal damage, does not suggest renal disease.	-1	The uric acid level, although a limited indicator of renal damage, does not suggest renal disease.	0
Yolk-related peritonitis	No, the modified transudate is not suggestive of yolk related peritonitis	-1	The modified transudate is not suggestive of yolk related peritonitis	1
Ceiling score	**6**	**Floor score**	**0**	

Page J

Differential Diagnosis

The abdominocentesis has dramatically resolved the birds respiratory distress and abdominal distension.

So our main problem list includes

Ascites
Hepatopathy
Catabolism

The differential diagnosis for ascites in birds is below

- Chronic liver disease
  - hypertension from fibrosis (aflatoxicosis, bacterial or viral cholangio-hepatitis, other toxins)
  - iron storage disease, amyloidosis
- Hypoalbuminaemia (also oedema)
  - chronic liver disease, nephrotic syndrome, protein losing enteropathies
- Neoplasia (abdominal carcinomas)
- Congestive heart failure (ducks and chickens)
- Myocarditis
  - Marek's (chickens), polyomavirus (parrots), bacterial
- Cystic ovary/right oviduct
- Trauma
- Viral serositis (exotic to Australasia)

Updated Plan

Based on your findings what would you do now? Select as many as are appropriate.

Multiple choice option	Results available?	comment if picked	Score if picked	comment if not picked	Score if not picked
Nothing. The respiratory distress has resolved. Send the bird home quickly.	N	The ascites will recur. Shame on you!	-1	The ascites will recur.	0
Supportive therapy for general liver disease at home. No further diagnostics required.	N	This is a viable option if the owner's finances are limited, and given the guarded prognosis that must be given for complete resolution at this point. However, failure to further pursue the diagnosis limits the specific treatmenst that can be used.	0	This is a viable option if the owner's finances are limited, and given the guarded prognosis that must be given for complete resolution at this point. However, failure to further pursue the diagnosis limits the specific treatmenst that can be used.	0
Radiography	N	Given that the respiratory distress has resolved and that much of the excess peritoneal fluid has been drained, this may help in differentiating potential causes of the ascites.	1	Given that the respiratory distress has resolved and that much of the excess peritoneal fluid has been drained, this may help in differentiating potential causes of the ascites.	0
Ultrasound	N	Given that the respiratory distress has resolved and that much of the excess peritoneal fluid has been drained, this may help in differentiating potential causes of the ascites.	1	Given that the respiratory distress has resolved and that much of the excess peritoneal fluid has been drained, this may help in differentiating potential causes of the ascites.	0
Exploratory laparotomy	Y	This is a viable option which will allow collection of biopsies of liver and potentially other organs. However, if there is cardiac disease associated with the ascites, this will not aid in diagnosis.	1	This is a viable option which will allow collection of biopsies of liver and potentially other organs. However, if there is cardiac disease associated with the ascites, this will not aid in diagnosis.	0
Ceiling score		**3**	**Floor score**		0

Page K

In this case, the clinician opted to perform an exploratory laparotomy and biopsy of the liver based on the clinical pathology findings.

The bird was anaesthetised by mask induction with isoflurane and oxygen. Intra-operative fluids (lactated ringers solution with 2.5% glucose) were given IV at 10mLs/kg/hr. Enrofloxacin and butorphanol were given intra-operatively.

The abdomen was approached using a ventral midline approach and remaining ascitic fluid suctioned. The ovary and oviduct were inactive and showed no evidence of abnormalities. The liver was shrunken, orange and had a firm nodular texture. A wedge biopsy of the liver and an air sac biopsy was performed. The bird lost ~2-3 mls of blood from the liver biopsy site and haemostasis achieved with gel-foam. The abdomen was closed in 2 layers with 5-0 vicryl. Post-operative recovery was uneventful.

Histology of the biopsies revealed marked nodular hyperplasia of hepatocytes widely separated by areas of biliary hyperplasia and fibrosis. There were focal areas of mixed monocytic and heterophilic inflammation within the fibrotic areas. The air sac was markedly thickened by fibrosis and contained pockets of eosinophilic fluid with low numbers of vacuolated macrophages.

The histological diagnosis was:

1. Chronic active hepatitis and nodular hyperplasia with fibrosis and biliary hyperplasia
2. Fibrotic air-sacculitis

The pathologist felt the liver changes were most consistent with chronic aflatoxicosis and that the air sac changes were consistent with change to the ascites.

Page L

Treatment Plan Page

Given this diagnosis, we need to develop a treatment plan. The owner was given a poor prognosis for return to breeding condition but elected to try some treatment. Choose what options for treatment of this case are suitable from the list below. Choose as many as are necessary

Multiple choice option	comment if picked	Score if picked	comment if not picked	Score if not picked
Dexamethasone	Corticosteroids are used by some avian veterinarians for treatment of chronic hepatic disease, but a much shorter acting corticosteroid such as prednisolone should be used to minimise impact on the HPA axis.	-1	Corticosteroids are used by some avian veterinarians for treatment of chronic hepatic disease, but a much shorter acting corticosteroid such as prednisolone should be used to minimise impact on the HPA axis.	0
Urso-deoxycholic acid	Ursodeoxycholic acid (UDCA) is useful in the treatment of cholestatic and inflammatory liver disease. UDCA is a hydrophilic bile acid that has cytoprotective effects on the bilary system by binding to cytotoxic hydrophilic bile acids that have accumulated due to cholestasis. It also acts to change the enterohepatic circulation of endogenous bile acids and enhances the bile flow, eliminating toxic bile acids from the liver. UDCA also decreases the involvement of hepatocytes and biliary epithelium in the inflammatory process. There have been no toxicity trials done on birds, but a limited number of cases suggest that this may be useful in conjunction with other therapies in the treatment of avian hepatic disease.	1	Ursodeoxycholic acid (UDCA) is useful in the treatment of cholestatic and inflammatory liver disease. UDCA is a hydrophilic bile acid that has cytoprotective effects on the bilary system by binding to cytotoxic hydrophilic bile acids that have accumulated due to cholestasis. It also acts to change the enterohepatic circulation of endogenous bile acids and enhances the bile flow, eliminating toxic bile acids from the liver. UDCA also decreases the involvement of hepatocytes and biliary epithelium in the inflammatory process. There have been no toxicity trials done on birds, but a limited number of cases suggest that this may be useful in conjunction with other therapies in the treatment of avian hepatic disease.	0
Colchicine	Colchinine is used in canine medicine to minimise further amyloid deposition in the liver, and this has been extrapolated for use in birds, although the usefulness in this species has not been documented. Colchinine works by blocking the	0	Colchinine is used in canine medicine to minimise further amyloid deposition in the liver, and this has been extrapolated for use in birds, although the usefulness in this species has not been documented. Colchinine works by blocking the	0

	synthesis and secretion of amyloid. It is also reported to have some anti-inflammatory and anti-fibrotic effects. It also facilitates excretion of copper from the liver. The use of colchinine for chronic hepatic fibrosis in birds is controversial as it is difficult to histologically document the lack of progression of fibrosis. However, there is some anecdotal evidence of clinical improvement.		synthesis and secretion of amyloid. It is also reported to have some anti-inflammatory and anti-fibrotic effects. It also facilitates excretion of copper from the liver. The use of colchinine for chronic hepatic fibrosis in birds is controversial as it is difficult to histologically document the lack of progression of fibrosis. However, there is some anecdotal evidence of clinical improvement.	
Enrofloxacin	There is evidence from the biopsy of continued active hepatitis. A wide variety of bacteria can infect the liver, either as a sequelae to a septicaemia or from an ascending cholangiohepatitis, especially with a concurrent enteritis. Birds seem to have a particular problem with the gram-negative enterobacteriaceae family. Appropriate antibiotics should be initiated, preferably after culture and sensitivity testing from a liver biopsy. Enrofloxacin is predominantly renally metabolised and would be a good choice for this case.	1	There is evidence from the biopsy of continued active hepatitis. A wide variety of bacteria can infect the liver, either as a sequelae to a septicaemia or from an ascending cholangiohepatitis, especially with a concurrent enteritis. Birds seem to have a particular problem with the gram-negative enterobacteriaceae family. Appropriate antibiotics should be initiated, preferably after culture and sensitivity testing from a liver biopsy.	0
Meloxicam	There are rare reports of hepatotoxicity in humans and dogs and this drug would best be avoided where the liver is severely compromised.	-1	There are rare reports of hepatotoxicity in humans and dogs and this drug would best be avoided where the liver is severely compromised.	0
Vitamin supplement	Hypovitaminosis is often a sequelae of hepatic disease, or can occur from a primary dietary deficiency. If owners can't or won't change over to a balanced pelleted diet, vitamin supplements should be added. If the diet is particularly unbalanced, a one-off injection of B vitamins may help. You may also wish to give a	1	Hypovitaminosis is often a sequelae of hepatic disease, or can occur from a primary dietary deficiency. If owners can't or won't change over to a balanced pelleted diet, vitamin supplements should be added. If the diet is particularly unbalanced, a one-off injection of B vitamins may help. You may also wish to give a	-1

	single injection of ADE also. As dietary supplements, vitamins A and D shouldn't be given more than once or twice a week. Excessive vitamin A can cause a hepatotoxicity, and excessive amounts of vitamin D can lead to tissue calcification. Vitamins B and E can be administered on a daily basis. If a coagulopathy is suspected, vitamin K should be given, especially pre-surgically or prior to endoscopy.		single injection of ADE also. As dietary supplements, vitamins A and D shouldn't be given more than once or twice a week. Excessive vitamin A can cause a hepatotoxicity, and excessive amounts of vitamin D can lead to tissue calcification. Vitamins B and E can be administered on a daily basis. If a coagulopathy is suspected, vitamin K should be given, especially pre-surgically or prior to endoscopy	
Aspirin	There is no indication for aspirin use and it may worsen haemostasis	-1	There is no indication for aspirin use and it may worsen haemostasis	0
Repeated abdominocentesis	Abdominocentesis should be performed for abrupt relief of severe dyspnoeia and for diagnostic purposes only. Removal of large volumes of fluid, or the repeated removal of fluid, may result in depletion of albumin, and may cause hypovolaemia.	-1	Abdominocentesis should be performed for abrupt relief of severe dyspnoeia and for diagnostic purposes only. Removal of large volumes of fluid, or the repeated removal of fluid, may result in depletion of albumin, and may cause hypovolaemia.	0
High quality dietary protein	Dietary aspects should be addressed in both acute and chronic cases of liver disease. The diet should be well balanced. Contrary to previous thoughts, it is now not recommended to restrict the amount of dietary protein as these patients are often in a catabolic state. An inadequate source of dietary protein results in further catabolism of muscle tissue, metabolising amino acids to ammonia. Cholestatic disease can lead to maldigestion of fats and consequential diarrhoea, so these birds should also be placed on a low fat diet.	1	Dietary aspects should be addressed in both acute and chronic cases of liver disease. The diet should be well balanced. Contrary to previous thoughts, it is now not recommended to restrict the amount of dietary protein as these patients are often in a catabolic state. An inadequate source of dietary protein results in further catabolism of muscle tissue, metabolising amino acids to ammonia. Cholestatic disease can lead to maldigestion of fats and consequential diarrhoea, so these birds should also be placed on a low fat diet.	-1
Itraconazole	There is no indication for antifungal therapy in this patient and given that this drug is metabolised by the liver it is best avoided in	-1	There is no indication for antifungal therapy in this patient and given that this drug is metabolised by the liver it is best avoided in	0

	this patient.		this patient.	
Lactulose	Lactulose is a synthetic non-absorbable dissacharide that is non-hydrolysable by mammalian and probably avian gut enzymes. This product supposedly acts to decrease the gut pH via conversion by bacteria to acetic and lactic acid. This results in the conversion of ammonia to ammonium, which is unable to be absorbed in the colon, and is expelled in faeces. The reduced pH is also said to decrease the gastrointestinal flora, and the lactulose has a cathartic effect, cleansing the gastrointestinal of endotoxins and metabolic byproducts. Unfortunately all this is based on mammalian studies and the GI flora of parrots are very different from mammals and there is no evidence that this has any beneficial effect in birds.	0	Lactulose is a synthetic non-absorbable dissacharide that is non-hydrolysable by mammalian and probably avian gut enzymes. This product supposedly acts to decrease the gut pH via conversion by bacteria to acetic and lactic acid. This results in the conversion of ammonia to ammonium, which is unable to be absorbed in the colon, and is expelled in faeces. The reduced pH is also said to decrease the gastrointestinal flora, and the lactulose has a cathartic effect, cleansing the gastrointestinal of endotoxins and metabolic byproducts. Unfortunately all this is based on mammalian studies and the GI flora of parrots are very different from mammals and there is no evidence that this has any beneficial effect in birds.	0
Phlebotomy	Phlebotomy is recommended to decrease the iron content in the body in cases of iron storage disease. It has no place in the treatment of this patient.	-1	Phlebotomy is recommended to decrease the iron content in the body in cases of iron storage disease. It has no place in the treatment of this patient.	0
Milk thistle extract (Silibinin)	Silibinin is a group of flavonoids extracted from milk thistle that is often used as a liver protectant. Work in mammals suggests this product has antioxidant effects. It also enhances the synthesis of protein and hepatocellular regeneration, suppresses fibrogensis and promotes fibrolysis.	1	Silibinin is a group of flavonoids extracted from milk thistle that is often used as a liver protectant. Work in mammals suggests this product has antioxidant effects. It also enhances the synthesis of protein and hepatocellular regeneration, suppresses fibrogensis and promotes fibrolysis.	0
Ceiling score		**5**	**Floor score**	**0**

Conclusion Page

In this case the bird was sent home on enrofloxacin 15mg/kg po (in nectar) bid, ursodeoxycholic acid (10 mg/kg in nectar SID) and suggestions were made about hygiene, the diet and vitamin supplementation which were ignored.The bird did well for 3 months, and then ascites and respiratory distress recurred. Abdominocentesis was performed at the owner's request which again resolved all signs of respiratory distress. The bird was found dead in its aviary 4 weeks later. Post mortem examination of it and a varied lorikeet from the same aviary were again suggestive of aflatoxicosis in both birds. The owner continues to sell his lorikeet diet commercially