Grace Animal Hospital and Pet Lodge
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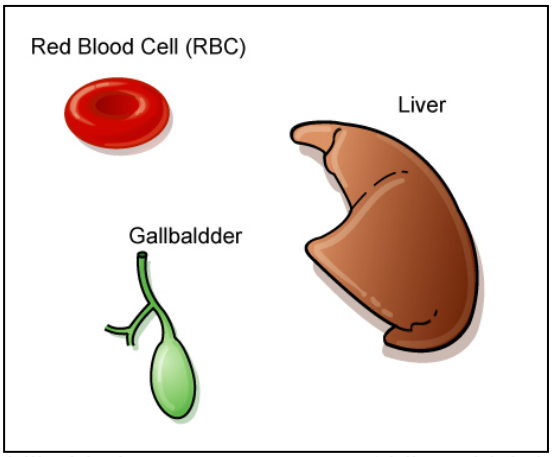
Testing for Patients Showing Jaundice

What is jaundice?

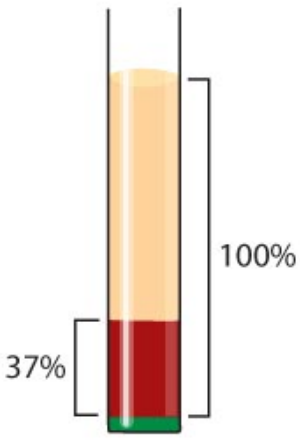
Jaundice (**also called icterus**) is a condition characterized by the accumulation of the bile pigment 'bilirubin' in the skin, mucous membranes, and sclera (the whites of the eyes), causing these tissues to become yellow in color.



What causes jaundice?

There are three major causes of jaundice: red blood cell destruction (also known as hemolysis), liver disease, and obstruction of the bile duct (called *cholestasis*).

In health, red blood cells are normally removed from the circulation when they become aged. These red blood cells are broken down into several components, one of which is bilirubin. The liver processes the bilirubin into a component of bile, which is stored in the gall bladder until it is required in the intestines for digestion. **Hyperbilirubinemia** (increased bilirubin concentration in blood) can occur if the increased destruction of red blood cells exceeds the liver's capacity to cope with the excessive levels of bilirubin, which spill over into the bloodstream, or it can occur if there is a problem with the processing or release of bilirubin by the liver or gall bladder. Regardless of the cause, if the concentration of bilirubin in the circulation becomes high enough it will begin to accumulate in the tissues, staining them the characteristic yellow color of jaundice



PCV – the percentage of the total volume of blood that represents cells after centrifugation.

How can we determine the cause of jaundice in my pet?

Generally, a CBC (complete blood count), a serum biochemical profile, and a urinalysis are recommended to determine the cause.

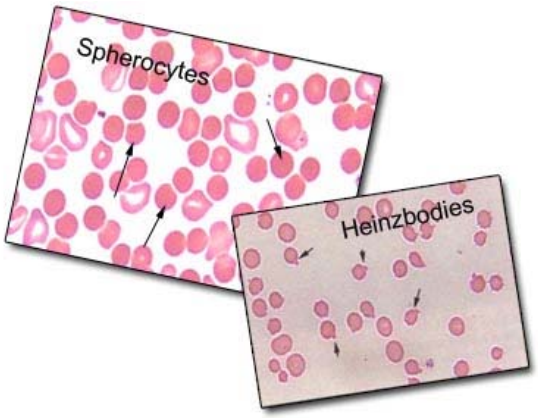
What changes in these screening tests will we

see if increased red blood cell destruction is the cause of jaundice in my pet?

The **<u>complete blood count (CBC)</u>** evaluates the red blood cells, the white blood cells, and the platelet components of a blood sample. A stained blood smear is evaluated microscopically along with a numerical evaluation of these blood components.

Evaluation of a CBC is **critical** in jaundiced patients because of the inter-relationship between red blood cells and the liver, as explained above.
The CBC will document the presence and severity of anemia by providing an evaluation of the total red blood cell numbers, the total hemoglobin, and the packed cell volume (PCV) of the blood sample.Changes noted microscopically on the blood smear may also give us information regarding the mechanism or cause of the red blood cell destruction.

For example, the appearance of large numbers of dense, rounded red blood cells called *spherocytes* are supportive of immune-mediated destruction of red blood cells.
Similarly the clumping or *agglutination* of small groups of red blood cells is suggestive of immune-mediated destruction of red blood cells.



The presence of a clear 'bubbles' at the edge of red blood cells (*Heinz bodies*) suggests that membrane damage to the red blood cells has occurred and may be resulting in their accelerated destruction because of increased fragility.

Occasionally the presence of red blood cell parasites such as Mycoplasma hemofelis is detected on the outer membrane of cat red blood cells. The presence of this parasite will result in the accelerated removal of red blood cells from circulation.

The presence of anemia, especially if it is moderate or severe suggests that hemolysis (red blood cell destruction) is the cause of the jaundice. The absence of significant anemia suggests that the liver, not increased red blood cell destruction, is the cause of the jaundice.

The major feature noted on the **<u>serum biochemistry profile</u>** when increased red blood cell destruction is the cause of jaundice is an increase in the serum bilirubin concentrations (hyperbilirubinemia). Mild changes in the liver related enzymes may be evident as a consequence of increased bilirubin levels.

A normal protein value on the biochemistry profile, in the presence of a moderate to severe anemia, will help us to confirm that red blood cell destruction, not blood loss, is the cause of the anemia. The measurement of electrolytes, specifically phosphorus, will allow us to exclude electrolyte imbalances as a cause of red blood cell destruction.

A **<u>urinalysis</u>** will confirm the presence of hyperbilirubinemia by documenting increased amounts of bilirubin in the urine sample. Furthermore the urinalysis may provide us with information regarding the site of red blood cell destruction, and may show whether any damage to the kidneys has occurred as a result of the red blood cell destruction.

Are there any further tests that might be used to confirm red blood cell destruction as a cause of jaundice in my pet?

Occasionally immune-mediated destruction of red blood cells is suspected, but cannot be definitively confirmed on the basis of the above screening tests. In this instance, a **Coombs' test**, which is a test to detect the presence of antibodies on the surface of the red blood cells, may be performed.

If *infectious agents* are suspected to be a cause of the hemolysis, then specific tests for their detection may be recommended. Such tests may require submission of blood to a referral laboratory, and include Mycoplasma hemofelis, feline leukemia virus and Ehrlichia.

What changes in these screening tests will we see if liver disease or gall bladder disease is the cause of jaundice in my pet?

The **CBC (complete blood count)** may indicate the presence of inflammation or infection within the liver and/or gall bladder by an increased white blood cell count. Anemia, if present, is usually very mild, and differs in character from the more severe anemia associated with red blood cell destruction or hemolysis.

The presence of certain shape changes in red blood cells is supportive of underlying liver disease.

The **serum biochemistry profile** contains many tests that are helpful in the diagnosis of liver disease. However, it must be stressed that although changes in the biochemistry profile may support the diagnosis of liver disease, they will rarely indicate the exact cause.

Destruction of individual liver cells (hepatocytes) is indicated by increases in the liver enzymes **ALT (alanine aminotransferase)** and **AST (aspartate transaminase)**. Such hepatocyte destruction may occur due to many causes including toxins, infectious diseases (bacterial and viral), alterations in liver blood flow, and tumors. The destruction of large numbers of individual hepatocytes may either impair the ability of the liver to process bilirubin, or may impair the flow of bile within the liver.

Cholestasis or blockage of bile flow within the liver or from the gall bladder to the intestine will result in increases in other liver related enzymes, namely **ALP (alkaline phosphatase)** and **GGT (gamma-glutamyltransferase)**. The causes of cholestasis include obstruction by gall bladder stones, cancer, trauma to the bile duct, and pancreatitis.

Occasionally complete bile duct obstruction may be suggested by changes in the **urinalysis**. In this instance, the absence of a urinary pigment called urobilinogen on multiple urine samples may support bile duct obstruction.

Many different conditions are listed as being the cause of these increased liver enzymes and bilirubin. So how do we determine what exactly is the underlying cause of disease in my pet?

In order to determine a specific cause of jaundice, we will need to perform additional tests on the liver and gall bladder will be required. The appropriate tests will depend on the clinical signs and history of your pet and the results of the initial screening tests.

Such testing may include an **ultrasound evaluation** of these organs to look at their general architecture and to look for the presence of tumors or gall bladder stones. The pancreas may be evaluated at this time to ensure that inflammation or masses within this nearby organ are not affecting liver or gall bladder function. *Radiographs* may be used either instead of or in addition to ultrasound evaluation.

Ultrasound machine

A sampling of tissue from the liver or gall bladder may be obtained using a fine needle (aptly called **fine-needle aspiration biopsy**), a **core biopsy** that uses a larger needle and harvests more cells, or a **surgical biopsy*.*** This material will be sent to a veterinary pathologist for evaluation. Because the liver is the site of production of proteins involved in blood clotting, the amount and functional activity of these proteins must be determined via a **coagulation panel** BEFORE any biopsies are performed.

Tissue and fluid from lesions in the liver or gall bladder might be sent to a veterinary referral laboratory for **bacterial culture** (this determines what types of bacteria, if any, are present).

If there is any **fluid within the abdomen** as a consequence of underlying liver or gall bladder disease, also it should be submitted to a veterinary pathologist for **cytological analysis**. The cells, protein content, and other features of this fluid may provide clues to the underlying cause of disease.

Finally, if ***infectious diseases*** such as feline leukemia, feline infectious peritonitis or fungal diseases are suspected of causing the liver related jaundice, then specific blood tests may be performed.

This client information sheet is based on material written by Kristiina Ruotsalo, DVM, DVSc, Dip ACVP & Margo S. Tant BSc, DVM, DVSc.