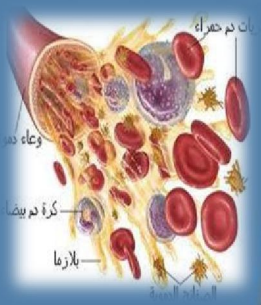
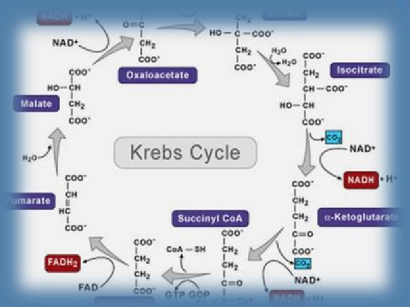
Al-Rasheed University College
Medical Analysis Department
Clinical Chemistry Lab.
Third Stage

كليـــــة الرشيد الجامعـــــــة
قســـــم التحليلات المرضيـــة
مختبر الكيميـــاء السريريـــة
المرحلـــــة الثالثـــــة





Lecture (5)

Liver Function:
- Alanine Transaminase (ALT)
- Aspartate Transaminase (AST)

Submitted by:
Ahmed Abdul Sattar Ali
Assistant Lecturer

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Alanine Transaminase (ALT)

Clinical Significance:

Serum alanine aminotransferase (ALT) is also called glutamic pyruvic transaminase (GPT).

An alanine aminotransferase (ALT) test measures the amount of this enzyme in the blood. ALT is found mainly in the liver, but also in smaller amounts in the kidneys, heart, muscles, and pancreas.

ALT is measured to see if the liver is damaged or diseased. Low levels of ALT are normally found in the blood. But when the liver is damaged or diseased, it releases ALT into the bloodstream, which makes ALT levels go up. Most increases in ALT levels are caused by liver damage.

The ALT test is often done along with other tests that check for liver damage, including aspartate aminotransferase (AST), alkaline phosphatase, lactate dehydrogenase (LDH), and bilirubin. Both ALT and AST levels are reliable tests for liver damage.

The purpose of test ordered:

The alanine aminotransferase (ALT) test is done to:

- Identify liver disease, especially cirrhosis and hepatitis caused by alcohol, drugs, or viruses.
- Help check for liver damage.
- Find out whether jaundice was caused by a blood disorder or liver disease.
- Keep track of the effects of medicines that can damage the liver.

Causes and investigation of abnormal results:

A low level of ALT in the blood is expected and is normal. Liver disease is the most common reason for higher than normal levels of ALT.

Very high levels of ALT (more than 10 times normal) are usually due to acute hepatitis, sometimes due to a viral infection. In acute hepatitis, ALT levels

usually stay high for about 1-2 months but can take as long as 3-6 months to return to normal. Levels of ALT may also be markedly elevated (sometimes over 100 times normal) as a result of exposure to drugs or other substances that are toxic to the liver or in conditions that cause decreased blood flow (ischemia) to the liver.

ALT levels are usually not as high in chronic hepatitis, often less than 4 times normal. In this case, ALT levels often vary between normal and slightly increased, so the test may be ordered frequently to see if there is a pattern. Other causes of moderate increases in ALT include obstruction of bile ducts, cirrhosis (usually the result of chronic hepatitis or bile duct obstruction), heart damage, alcohol abuse, and with tumors in the liver.

ALT is often performed together with a test for AST or as part of a liver panel. For more about ALT results in relation to other liver tests. In most types of liver diseases, the ALT level is higher than AST and the AST/ALT ratio will be low (less than 1). There are a few exceptions; the AST/ALT ratio is usually greater than 1 in alcoholic hepatitis, cirrhosis, and with heart or muscle injury and may be greater than 1 for a day or two after onset of acute hepatitis.

⊙ Principle of the method:

$$\alpha - \text{oxoglutarate} + \text{L} - \text{alanine} \xrightarrow{\text{ALT}} \text{L} - \text{glutarate} + \text{pyruvate}$$

Alanine Aminotransferase is measured by monitoring the concentration the pyruvate hydrazone formed with 2,4- dinitrophenyl-hydrazine.

⊙ Procedure:

➲ Assay conditions:

- Wavelength …… 546 nm.
- Cuvette ……... 1 cm light path.

	Reagent Blank	Sample
Sample	------	**0.1 ml**
R_1 (Buffer)	**0.5 ml**	**0.5 ml**
Distilled Water	**0.1 ml**	------
Mix and incubate for exactly 30 min at (37)°C		
R_2 (2,4-DNP)	**0.5 ml**	**0.5 ml**
Mix and allow to stand for exactly 20 min at (25) °C		
R_3 (Sodium hydroxide)	**5.0 ml**	**5.0 ml**
Mix and read the absorbance of sample against the reagent blank after 5 min		

➲ **Calculation:**

Absorbance	U/l	Absorbance	U/l
0.025	**4**	**0.275**	**48**
0.050	**8**	**0.300**	**52**
0.075	**12**	**0.325**	**57**
0.100	**17**	**0.350**	**62**
0.125	**21**	**0.375**	**67**
0.150	**25**	**0.400**	**72**
0.175	**29**	**0.425**	**77**
0.200	**34**	**0.450**	**83**
0.225	**39**	**0.475**	**88**
0.250	**43**	**0.500**	**94**

Aspartate Transaminase (AST)

Clinical Significance:

serum aspartate Transaminase (AST) is also called glutamic oxaloacetic transaminase (GOT).

Aspartate aminotransferase (AST) is an enzyme found in cells throughout the body but mostly in the heart and liver and, to a lesser extent, in the kidneys and muscles. In healthy individuals, levels of AST in the blood are low. When liver or muscle cells are injured, they release AST into the blood. This makes AST a useful test for detecting or monitoring liver damage.

A number of conditions can cause injury to liver cells and may cause increases in AST. The test is most useful in detecting liver damage due to hepatitis, drugs toxic to the liver, cirrhosis, or alcoholism. AST, however, is not specific for the liver and may be increased in conditions affecting other parts of the body.

An AST test is often performed along with an alanine aminotransferase (ALT) test. Both are enzymes found in the liver that become elevated in the blood when the liver is damaged. A calculated AST/ALT ratio is useful for differentiating between different causes of liver injury and in recognizing when the increased levels may be coming from another source, such as heart or muscle injury.

The purpose of test ordered:

AST may be ordered as part of a comprehensive metabolic panel (CMP) when someone has a routine health examination.

An AST test may be ordered along with several other tests when a person has signs and symptoms of a liver disorder. Some of these may include:

- Weakness, fatigue.
- Loss of appetite.
- Nausea, vomiting.

- Abdominal swelling and/or pain.
- Jaundice.
- Dark urine, light-colored stool.
- Itching (pruritus).
- Swelling in the legs and ankles.
- Tendency to bruise easily

AST may also be ordered, either by itself or with other tests, for people who are at an increased risk for liver disease since many people with mild liver damage will have no signs or symptoms. Some examples include:

- Persons who might have been exposed to hepatitis viruses.
- Persons who are heavy drinkers.
- Persons who have a history of liver disease in their family.
- Persons taking drugs that can damage the liver.
- Persons who are overweight and/or have diabetes

When AST is used to monitor treatment of persons with liver disease, it may be ordered on a regular basis during the course of treatment to determine whether the therapy is effective.

Causes and investigation of abnormal results:

Low levels of AST in the blood are expected and are normal.

Very high levels of AST (more than 10 times normal) are usually due to **acute hepatitis**, sometimes due to a viral infection. With acute hepatitis, AST levels usually stay high for about 1-2 months but can take as long as 3-6 months to return to normal. Levels of AST may also be markedly elevated (often over 100 times normal) as a result of exposure to drugs or other substances that are **toxic** to the liver as well as in conditions that cause decreased blood flow (**ischemia**) to the liver.

With **chronic hepatitis**, AST levels are usually not as high, often less than 4 times normal, and are more likely to be normal than are ALT levels. AST often

varies between normal and slightly increased with chronic hepatitis, so the test may be ordered frequently to determine the pattern. Such moderate increases may also be seen in other diseases of the liver, especially when the **bile ducts are blocked**, or with **cirrhosis** or **certain cancers of the liver**. AST may also increase after heart attacks and with muscle injury, usually to a much greater degree than ALT.

AST is often performed together with the ALT test or as part of a liver panel. For more about AST results in relation to other liver tests.

In most types of liver disease, the ALT level is higher than AST and the AST/ALT ratio will be low (less than 1). There are a few exceptions; the AST/ALT ratio is usually increased in **alcoholic hepatitis**, **cirrhosis**, **hepatitis C virus-related chronic liver disease**, and in the **first day or two of acute hepatitis** or injury from **bile duct obstruction**. With heart or muscle injury, AST is often much higher than ALT (often 3-5 times as high) and levels tend to stay higher than ALT for longer than with liver injury.

⭘ Principle of the method:

$$\alpha - \text{oxoglutarate} + \text{L} - \textit{aspartate} \xrightarrow{\text{AST}} \text{L} - \text{glutamate} + \text{Oxaloacetate}$$

Aspartate Aminotransferase is measured by monitoring the concentration the concentration of oxaloacetate hydrazone formed with 2,4-dinitrophenyl-hydrazine.

⭘ Procedure:

➲ Assay conditions:

- Wavelength …… 546 nm.
- Cuvette ……... 1 cm light path.

	Reagent Blank	Sample
Sample	------	**0.1 ml**
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R_3 (Sodium hydroxide)	**5.0 ml**	**5.0 ml**
Mix and read the absorbance of sample against the reagent blank after 5 min		

➲ **Calculation:**

Absorbance	U/l	Absorbance	U/l
0.020	**7**	**0.100**	**36**
0.030	**10**	**0.110**	**41**
0.040	**13**	**0.120**	**47**
0.050	**16**	**0.130**	**52**
0.060	**19**	**0.140**	**59**
0.070	**23**	**0.150**	**67**
0.080	**27**	**0.160**	**76**
0.090	**31**	**0.170**	**89**