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A review about liver function tests

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Abstract

In general, Tests for liver function in the laboratory are those that help diagnose and treat patients with hepatic dysfunction. The liver is responsible for the metabolism of fats., proteins, and carbohydrates. As biochemical markers of liver dysfunction, a few end products of metabolic pathways and enzymes that are extremely sensitive to abnormalities could be employed. Serum bilirubin, Ceruloplasmin, α-fetoprotein, alkaline phosphatase, 5′ nucleotidase, aspartate amino transferase, alanine amino transferase, and gamma glutamyl transferase are a few of the biological. If a patient has one or more changes in the biochemical markers of liver damage, physicians may have trouble detecting diseases that directly affect the liver or include other organs. The phrase "liver chemistry tests," which refers to a variety of serum chemistries that can be examined to assess hepatic function and/or damage, is often used but is not well defined.

Keywords: Serum Bilirubin; Alanine amino transferase; Aspartate amino transferase; Alkaline phosphatase; Gamma Glutamyl Transferase; Ceruloplasmin; α-fetoprotein

1. Liver function test

1.1. Serum Bilirubin

The primary tetrapyrrole molecule found in gastric juice is bilirubin, which is produced when hemoglobin (Hb) breaks down. It has a yellow hue [1]. After going through several stages of breakdown, the free bilirubin bonds with albumin and travels via the blood to the liver. Due to its insoluble nature, this bilirubin travels through the bile ducts and eventually enters the colon as insoluble salt along with other bile elements. In the digestive system, bilirubin is converted by bacterial enzymes into a variety of similar chemicals that combine to create urobilinogen [2]. "Indirect" or unconjugated bilirubin (UCB) is produced when alcohol is present in the bilirubin-diazo reagent reaction, whereas "direct" or conjugated bilirubin (CB) is produced when alcohol is not present. When it comes to indirect or unconjugated bilirubin, the typical quantity in serum is thought to be insoluble. Bilirubin's solubility has been restored in the liver through conjugation with glucuronide [3].

1.2. Alanine amino transferase ALT

The enzyme alanine aminotransferase (ALT) helps the body metabolize nitrogen in cells and promotes the process of liver gluconeogenesis by converting alanine and α-ketoglutarate into pyruvate and glutamate. Men's normal blood ALT levels vary from 27.0 to 17.3 IU/L, while women's normal blood ALT levels range from 17.7 to 11.2 IU/L [4,5]. It has been demonstrated that measuring the amount of ALT in human serum is a useful biomarker of liver function. The amount of ALT in the blood quickly increases when the liver or any other organ is damaged [6].

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Similar to ALT, aspartate aminotransferase (AST) is an enzyme that is present in nearly all bodily tissues but is lacking in bonesThe reversible amino group exchange between glutamate and aspartate is detected by AST. Serum glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT) are other names for these enzymes [7]. For men, a normal blood AST level is 24.1 + 8.7 IU/L, while for women, it is 18.9 + 8.9 IU/L. These enzymes are found in heart cells, muscle tissue, and red blood cells. as well as organs including the kidney, pancreas, and liver. An unusually high amount of AST is seen in blood serum when there is damage to the hepatocytic cells or any of the aforementioned tissues[8].

1.3. Aspartate amino transferase, (AST)

Aspartate aminotransferase (AST) is involved in gluconeogenesis in the liver and intermediate metabolism [9]. The liver, heart, kidneys, muscles, brain, and blood cells can all contain AST. Although it is most frequently detected in the liver, ALT can also be discovered in plasma and other bodily organs. According to the degree of hepatocellular damage brought on by toxic substances, viral infections, or other liver damage-causing factors, liver tissue releases AST and ALT into the bloodstream [10]. Serum ALT has higher enzymatic activity than serum AST in the majority of liver diseases [11]. Clinical laboratories frequently use an enzymatic test to evaluate blood AST and ALT activity, [12].

Since individuals with liver illness frequently do not exhibit symptoms until their livers have significantly deteriorated, the development of an effective diagnostic technique is essential for the early diagnosis and appropriate treatment of liver disease [13]. Serum AST and ALT levels can be measured enzymatically to diagnose the majority of liver disorders [14, 15]. The enzymatic approach, however, does not accurately depict the level of liver fibrosis. Patients suffering from chronic liver disorders such cirrhosis, fatty liver disease, and hepatocellular cancer may receive a false diagnosis as a result of it [16].

1.4. Alkaline phosphatase ALP

The enzyme known as alkaline phosphatase (ALP) is responsible for catalyzing the dephosphorylation of several essential proteins and nucleic acids. Thus, ALP activities invariably coincide with a wide spectrum of physiological and pathological processes, making it a crucial biomarker in clinical and industrial applications. To address point-of-care testing needs and enhance sensitivity and selectivity in diverse biological settings, a multitude of ALP assays and immunoassay techniques have been thoroughly examined. The first thorough summary of current developments in all the main ALP-targeting and reporting assay schemes, such as colorimetric, fluorometric, electrochemical, and chemiluminescence approaches, is given in this review[17].

1.5. Gamma Glutamyl Transferase GGT

Gamma-glutamyl transferase (GGT) is a frequently used marker of liver damage and an indicator of alcohol intake. Advances in these fields and our understanding of its physiological role in reducing oxidative stress by breaking down extracellular glutathione and providing the cells with the amino acids that make it up have both increased in recent years. Conditions such as obstructive liver disease, heavy alcohol consumption, and the use of medications that stimulate enzymes boost blood GGT and increase the generation of free radicals and the danger of glutathione depletion. Nevertheless, the products of the GGT reaction may increase the production of free radicals, particularly when iron is present. Determining the correlations between serum GGT and coronary heart disease risk has also advanced significantly [18].

A crucial transferase in the transpeptidation of functional gamma-glutamyl groups to receptor molecules is gamma-glutamyl transferase (γGT). From a biological standpoint, γGT exhibits high sensitivity in diagnosing liver injury; nevertheless, the loss of specificity for damage and its low specificity for certain aetiologies can result from enzyme stimulation. According to more recent research, it may also be crucial for the metabolism of xenobiotics and antioxidant defense. It also has intriguing connections to a variety of disease states, such as cancer and cardiovascular disease. [19, 20].

1.6. α-fetoprotein AFP

As a tumor-related fetal protein, albuminoid proteins are referred to as AFP (α-fetoprotein) as a target indicator. Increased AFP concentrations are linked to several diseases, including liver cancer. The development of rapid, highly sensitive, and selective techniques is necessary to enable early detection at trace quantities. Because of this, a number of biosensing platforms have been created. One of the most efficient techniques is emerging: new optical biosensors. Optical detection is superior to other techniques because it can see the target marker without the need for expensive instruments. Thus, This research elucidates the role that these innovative biosensors play in the critical early detection of AFP, which is required for the diagnosis of cancer [21].

Alpha-albumin, albumin, vitamin D binding Gc protein, AFP-gene–associated protein ARG, and the AFP molecule are the five members of the albuminoid protein family. AFP is a multipurpose glycoprotein target marker. The AFP gene, which is located on the long arm of chromosomal number 4, encodes the 591 amino acids that make up AFP [22]. Different bodily fluids can contain AFP, which can be used for diagnosis, staging, recurrence surveillance, and prognosis evaluation. Because of its dual role in both fetal and tumor activity, Tumor-related fetal proteins, such as the AFP molecule, are categorized as "oncofetal" proteins. The AFP molecule is expressed in that order throughout development by the gastrointestinal tract, the fetal liver, and the yolk sac cells. Furthermore, in the developing fetus, it acts as the main binding protein [22, 23].

The function of AFP determination in the control of carcinogenic and ontogenetic growth has been studied recently [24]. When AFP was measured in biological fluids throughout fetal development, abnormally high quantities were found to be correlated with both abnormalities and problems in the fetus [25, 26].

1.7. Ceruloplasmin

Within the plasma protein portion of α2-glycoproteins is ceruloplasmin (CP). It makes up 95% of the total copper that is circulating in healthy humans and is produced in the liver by combining copper, mostly from the food. In addition to being involved in the metabolism of iron and copper, CP is an acute-phase reactant that can produce free radicals, which have been linked to a number of diseases, in addition to acting as an antioxidant [27, 28]. It's noteworthy to note that CP will take some time to reflect changes in dietary copper availability because most of the plasma copper that will eventually cause CP comes from meals that were consumed weeks or months earlier rather than from recent meals [29].

2. Conclusion

Tests for liver illness in the lab can shed light on changes that take place in specific liver disease indicators. Evaluation of the atypical enzyme patternsdiagnosis is aided by the main pattern of alteration, degree of alteration (for aminotransferases), pace of change, type of alteration course, independent elevation, conjugation with another parameter, or follow-up period ranging from six months to two years. , Because high levels can be found in healthy people who do not exhibit any symptoms, and because many significant liver disorders can be linked with normal levels, a single laboratory liver test is not very helpful in the screening procedure for liver sickness. When the patient's symptoms are taken into consideration, the pattern of aberrant enzyme activity can help guide the following diagnosis.

Compliance with ethical standards

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