MAYO CLINIC LABORATORIES

Web: mayocliniclabs.com
Email: mcl@mayo.edu
Telephone: 800-533-1710
International: +1 855-379-3115
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Test ID: ALKI
Alkaline Phosphatase, Total and Isoenzymes, Serum

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Useful For

Diagnosis and treatment of liver, bone, intestinal, and parathyroid diseases

Determining the tissue source of increased alkaline phosphatase (ALP) activity in serum

Differentiating between liver and bone sources of elevated ALP

Clinical Information

Alkaline phosphatase (ALP) is present in a number of tissues including liver, bone, intestine, and placenta. The activity of ALP found in serum is a composite of isoenzymes from those sites and, in some circumstances, placental or Regan isoenzymes. Serum ALP is of interest in the diagnosis of 2 main groups of conditions-hepatobiliary disease and bone disease associated with increased osteoblastic activity.

A rise in ALP activity occurs with all forms of cholestasis, particularly with obstructive jaundice. The response of the liver to any form of biliary tree obstruction is to synthesize more ALP. The main site of new enzyme synthesis is the hepatocytes adjacent to the biliary canaliculi.

ALP is also elevated in disorders of the skeletal system that involve osteoblast hyperactivity and bone remodeling, such as Paget disease, rickets, osteomalacia, fractures, and malignant tumors.

Moderate elevation of ALP may be seen in other disorders such as Hodgkin disease, congestive heart failure, ulcerative colitis, regional enteritis, and intra-abdominal bacterial infections.

Reference Values

ALKALINE PHOSPHATASE

Males

0-14 days: 83-248 U/L

15 days-<1 year: 122-469 U/L

1-<10 years: 142-335 U/L

10-<13 years: 129-417 U/L

13-<15 years: 116-468 U/L

15-<17 years: 82-331 U/L

17-<19 years: 55-149 U/L

> or =19 years: 40-129 U/L

Females

0-14 days: 83-248 U/L

15 days-<1 year: 122-469 U/L

1-<10 years: 142-335 U/L

10-<13 years: 129-417 U/L

13-<15 years: 57-254 U/L

15-<17 years: 50-117 U/L

> or =17 years: 35-104 U/L

ALKALINE PHOSPHATASE ISOENZYMES

Liver 1%

0-6 years: 5.1-49.0%

7-9 years: 3.0-45.0%

10-13 years: 2.9-46.3%

14-15 years: 7.8-48.9%

16-18 years: 14.9-50.5%

> or =19 years: 27.8-76.3%

Liver 1

0-6 years: 7.0-112.7 IU/L

7-9 years: 7.4-109.1 IU/L

10-13 years: 7.8-87.6 IU/L

14-15 years: 10.3-75.6 IU/L

16-18 years: 13.7-78.5 IU/L

> or =19 years: 16.2-70.2 IU/L

Liver 2%

0-6 years: 2.9-13.7%

7-9 years: 3.7-12.5%

10-13 years: 2.9-22.3%

14-15 years: 2.2-19.8%

16-18 years: 1.9-12.5%

> or =19 years: 0.0-8.0%

Liver 2

0-6 years: 3.0-41.5 IU/L

7-9 years: 4.0-35.6 IU/L

10-13 years: 3.3-37.8 IU/L

14-15 years: 2.2-32.1 IU/L

16-18 years: 1.4-19.7 IU/L

> or =19 years: 0.0-5.8 IU/L

Bone %

0-6 years: 41.5-82.7%

7-9 years: 39.9-85.8%

10-13 years: 31.8-91.1%

14-15 years: 30.6-85.4%

16-18 years: 38.9-72.6%

> or =19 years: 19.1-67.7%

Bone

0-6 years: 43.5-208.1 IU/L

7-9 years: 41.0-258.3 IU/L

10-13 years: 39.4-346.1 IU/L

14-15 years: 36.4-320.5 IU/L

16-18 years: 32.7-214.6 IU/L

> or =19 years: 12.1-42.7 IU/L

Intestine %

0-6 years: 0.0-18.4%

7-9 years: 0.0-18.3%

10-13 years: 0.0-11.8%

14-15 years: 0.0-8.2%

16-18 years: 0.0-8.7%

> or =19 years: 0.0-20.6%

Intestine

0-6 years: 0.0-37.7 IU/L

7-9 years: 0.0-45.6 IU/L

10-13 years: 0.0-40.0 IU/L

14-15 years: 0.0-26.4 IU/L

16-18 years: 0.0-12.7 IU/L

> or =19 years: 0.0-11.0 IU/L

Placental

Not present

Interpretation

Total Alkaline Phosphatase:

Alkaline phosphatase (ALP) elevations tend to be more marked (more than 3-fold) in extrahepatic biliary obstructions (eg, by stone or cancer of the head of the pancreas) than in intrahepatic obstructions; the more complete the obstruction, the greater the elevation. With obstruction, serum ALP activities may reach 10 to 12 times the upper limit of normal, returning to normal upon surgical removal of the obstruction. The ALP response to cholestatic liver disease is similar to the response of gamma-glutamyltransferase (GGT) but more blunted. If both GGT and ALP are elevated, a liver source of the ALP is likely.

Among bone diseases, the highest level of ALP activity is encountered in Paget disease, as a result of the action of the osteoblastic cells as they try to rebuild bone that is being resorbed by the uncontrolled activity of osteoclasts. Values from 10 to 25 times the upper limit of normal are not unusual. Only moderate rises are observed in osteomalacia, while levels are generally normal in osteoporosis. In rickets, levels 2 to 4 times normal may be observed. Primary and secondary hyperparathyroidism are associated with slight to moderate elevations of ALP; the existence and degree of elevation reflects the presence and extent of skeletal involvement. Very high enzyme levels are present in patients with osteogenic bone cancer. A considerable rise in ALP is seen in children following accelerated bone growth.

ALP increases of 2 to 3 times normal may be observed in women in the third trimester of pregnancy, although the reference interval is very wide and levels may not exceed the upper limit of normal in some cases. In pregnancy, the additional enzyme is of placental origin.

ALP Isoenzymes:

Liver ALP isoenzyme is associated with biliary epithelium and is elevated in cholestatic processes. Various liver diseases (primary or secondary cancer, biliary obstruction) increase the liver isoenzyme.

Liver 1 (L1) is increased in some nonmalignant diseases (such as cholestasis, cirrhosis, viral hepatitis, and in various biliary and hepatic pathologies). It is also increased in malignancies with hepatic metastasis, in cancer of the lungs and digestive tract, and in lymphoma.

An increase of liver 2 (L2) may occur in cholestasis and biliary diseases (eg, cirrhosis, viral hepatitis) and in malignancies (eg, breast, liver, lung, prostate, digestive tract) with liver metastasis.

Osteoblastic bone tumors and hyperactivity of osteoblasts involved in bone remodeling (eg, Paget disease) increase the bone isoenzyme. Paget disease leads to a striking, solitary elevation of bone ALP.

The intestinal isoenzyme may be increased in patients with cirrhosis and in individuals who are blood group O or B secretors.

The placental (carcino-placental antigen) and Regan isoenzyme can be elevated in cancer patients.

Cautions

No significant cautionary statements

Clinical Reference

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