

THE ZINC SULFATE TURBIDITY TEST AND LIVER DISEASE

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THE zinc sulfate turbidity test has become a useful test in the diagnosis of liver disease because of its simplicity and reliability in detecting increased gamma-globulin levels. The zinc sulfate turbidity test was introduced in 1947 by Kunkel¹ as a simple means of determining the serum gamma-globulin level. However, the zinc sulfate turbidity test has not been used so extensively as the other turbidity and flocculation tests (cephalin and thymol) for liver function. This paper proposes to show the value and usefulness of the zinc sulfate turbidity by reviewing results of tests performed on patients at the Cleveland Clinic.

The results of zinc sulfate turbidity tests were compared with the clinical diagnoses in over 1,200 patients.² The diagnoses of these patients were divided into seven categories as follows: (1) normal or no evidence of organic disease; (2) noninfectious, nonhepatic diseases; (3) cirrhosis; (4) hepatitis; (5) obstructive jaundice; (6) infectious diseases; and (7) metastatic hepatic disease. The method of performing the zinc sulfate turbidity tests was the same as that originally described by Kunkel.¹

Figure 1 represents the results of tests on 391 patients considered normal or having functional complaints with no evidence of organic disease. The mean zinc sulfate turbidity value was 6.42 ± 2.54 units. This study did not differentiate test results with regard to race, however, only a few patients were Negroes.³ Only eight patients had turbidity values higher than 12 units. Studies on more than 200 apparently healthy blood bank donors ranged from 2 to 12 units with one exception. This donor had a value of 16 and later was found to have an ovarian cyst. Two months after the cyst was removed the zinc sulfate turbidity value was normal.

The results of tests on 510 patients with noninfectious, nonhepatic organic disease are also summarized in Figure 1. The mean was 7.78 ± 7.28 units. Tests done on 57 patients (11.2 per cent) gave values greater than 12 units. Four patients with multiple myeloma had the highest values (80, 73, 72, and 64 units). These four patients had very high gamma-globulin fractions in addition to greatly elevated serum globulin levels. In 12 other patients with values of 19 units or higher, there were 4 cases of ulcerative colitis, 3 cases of rheumatoid arthritis, and a case each of hemolytic anemia, myelofibrosis, lymphoblastoma,

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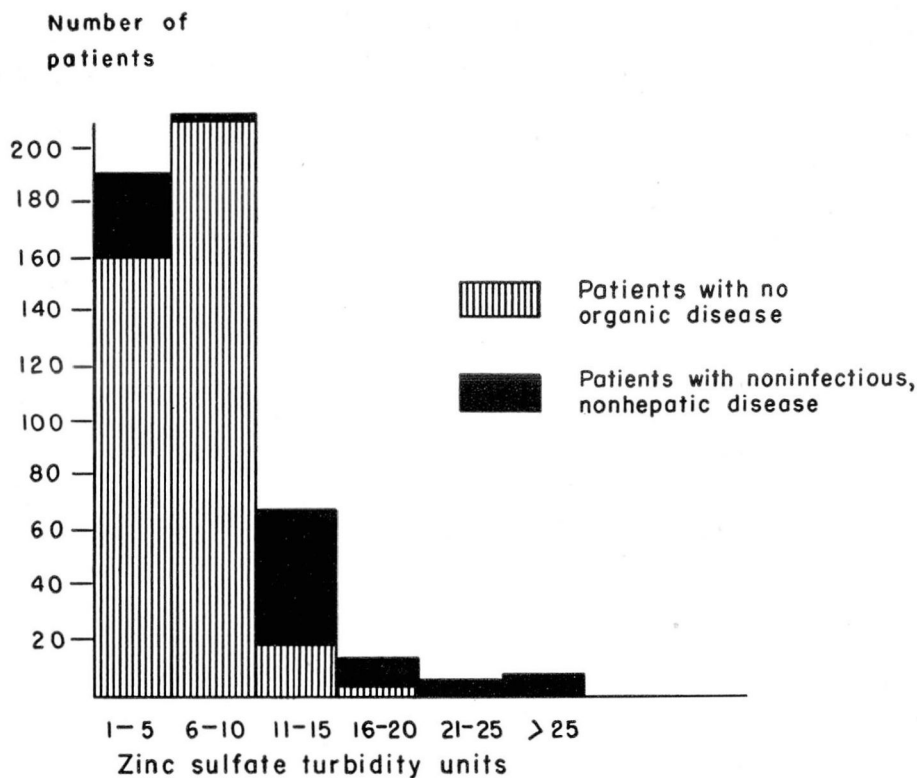


Fig. 1

essential hypertension, and nephritis. All of these conditions can be associated with an elevated level of gamma-globulin.

The results of tests done on 186 patients with hepatic cirrhosis are summarized in Figure 2. Values are included from all stages of both Laennec's and postnecrotic cirrhosis. Of the 186 tests, 122 (65.6 per cent) were higher than 12 units, and 57 (30.6 per cent) of the 122 were higher than 20 units. The mean was 17.10 ± 8.80 units. In our laboratory the zinc sulfate turbidity value is elevated more often in chronic hepatic disease than are the results of other turbidity or flocculation tests. The zinc sulfate turbidity test has its greatest usefulness in the diagnosis of cirrhosis, and usually the more chronic the disease the higher the value.

Figure 2 also summarizes zinc sulfate turbidity tests in 54 patients having infectious hepatitis. Of the 54, 20 (37 per cent) were found to have elevated zinc sulfate turbidity values. The highest values were seen in chronic or recurrent hepatitis, which suggests that each recurrence or exacerbation of the disease results in an increased antibody titer.

Zinc sulfate turbidity values were usually not elevated in patients having obstructive jaundice. Only 4 (9.5 per cent) of 42 patients in this group had

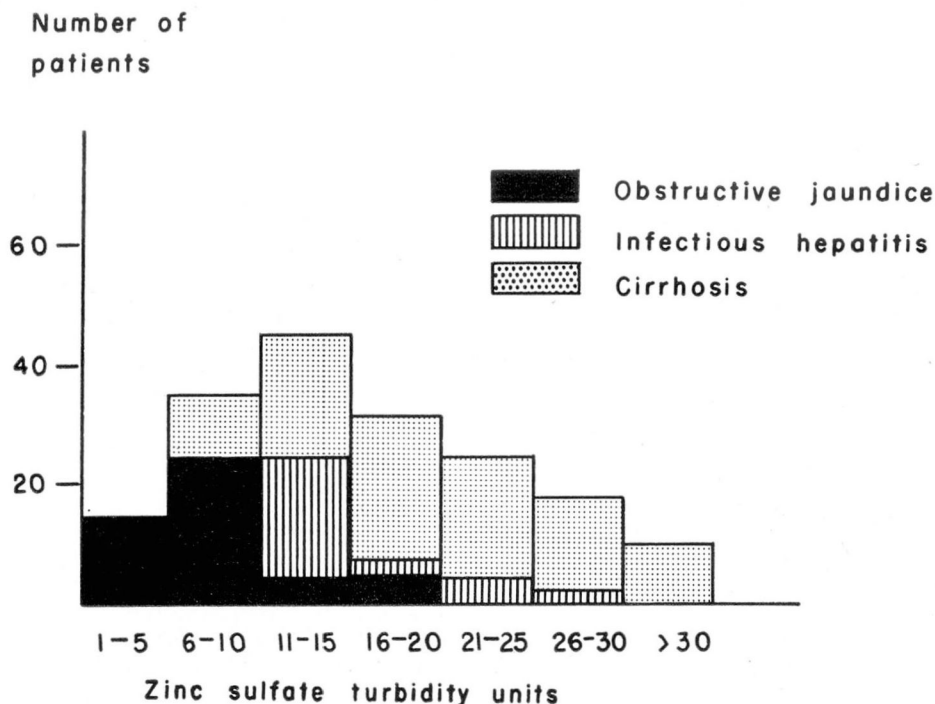


Fig. 2

values higher than 12. Of these four, one patient with a zinc sulfate turbidity of 18 units had a carcinoma of the ampulla of Vater with hepatic failure which probably accounts for the elevated results. In this group were included four patients having chlorpromazine jaundice; all four showed normal zinc sulfate turbidity values. The zinc sulfate turbidity is most significant when it is normal in the presence of long-standing jaundice in indicating an obstruction of the bile duct rather than a hepatocellular cause of the jaundice.⁴ The values in obstructive jaundice, however, are no lower than normal. Like the other liver function tests, the zinc sulfate turbidity test does not differentiate extrahepatic from chlorpromazine jaundice.⁵

Zinc sulfate turbidity values were elevated in 4 of 12 patients with infectious disease and in 2 of 14 with hepatic metastasis. These elevated results probably reflect the gamma-globulin values associated with high rate of antibody formation.

Of the 1,200 patients whose results were reviewed, 13 had zinc sulfate turbidity values of 1 unit or lower. Of these 13 patients, 9 had advanced renal disease, 1 had idiopathic acquired hemolytic anemia, 2 had metastatic cancer, and 1 had chlorpromazine jaundice and arteriosclerotic heart disease with congestive failure. Electrophoretic studies showed in 80 per cent of these

patients a low total protein and a low gamma-globulin. Hayles⁶ has reported low zinc sulfate turbidity values in patients with agammaglobulinemia.

Comparison of 174 zinc sulfate turbidity tests with electrophoretic studies gave a correlation coefficient of 0.59 between zinc sulfate turbidity and gamma-globulin. This is similar to the coefficient of 0.67 found by De la Huerza and his associates.⁷ A somewhat better correlation, 0.63, was found when albumin—gamma-globulin ratios were compared with results of the zinc sulfate turbidity test. No significant correlation could be shown between albumin, alpha-globulin, or beta-globulin and the zinc sulfate turbidity.²

Discussion

The zinc sulfate turbidity is elevated in any disease in which the gamma-globulin is elevated. As liver disease becomes more chronic, gamma-globulin levels rise with resulting abnormal zinc sulfate turbidity. The zinc sulfate turbidity is higher in cirrhosis which follows infectious hepatitis than in nutritional or alcoholic cirrhosis.⁸ The zinc sulfate turbidity test may not reflect small variations in gamma-globulin but can be depended upon to detect gross elevations.

The zinc sulfate turbidity is within normal limits in obstructive jaundice. When the zinc sulfate turbidity remains normal in the presence of jaundice there is a strong indication for surgery. On the other hand, an elevated zinc sulfate turbidity with jaundice may indicate a hepatocellular jaundice and warrants watchful medical management rather than surgery.

The zinc sulfate turbidity test may be of value in the diagnosis of low gamma-globulin levels. Although no patient with agammaglobulinemia was studied here, the zinc sulfate turbidity should be helpful in its detection.

Summary

Over 1,200 clinical diagnoses and zinc sulfate turbidity tests were compared to evaluate the zinc sulfate turbidity as an aid in the diagnosis of hepatocellular disease. The zinc sulfate turbidity test is valuable in the diagnosis of chronic liver disease, particularly cirrhosis. It is of value in the follow-up of hepatitis, becoming elevated if the disease becomes chronic. The zinc sulfate turbidity test is especially valuable in the differential diagnosis of long-standing jaundice—when within normal limits it indicates biliary obstruction and when elevated it may indicate hepatocellular disease.

The zinc sulfate turbidity correlates well with gamma-globulin as determined by electrophoretic protein studies. It can be used as a semiquantitative approximation of the gamma-globulin where electrophoretic protein studies are not available.

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