SERUM LIPOPROTEINS AND PHOSPHOLIPIDS IN RELATION TO FATTY LIVER IN KWASHIORKOR*

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The present studies were intended to test two hypotheses that might explain fatty liver in kwashiorkor:

1. Decreased synthesis of the protein part of lipoproteins resulting from dietary protein deficiency could impede transport of lipids from the liver. In experimental animals, agents which inhibit protein synthesis, like ethionine and puromycin, cause a fatty liver with low serum lipids.[1,2] The same combination is seen in kwashiorkor before treatment.[3] The only published reports on serum lipoproteins in kwashiorkor both describe a relative and absolute decrease of α-lipoproteins.[4,5] The method used was scanning of paper electrophoretic strips, which is not very reliable. If this can be confirmed it would be of interest because α-lipoproteins contain more protein than β-lipoproteins.

2. Lipotropic factor deficiency. Combined dietary deficiency of choline and methionine could impair synthesis of lecithin (phosphatidyl choline) which is the main transport phospholipid in serum. The use in medicine of preparations containing lipotropic factors is based on very little human evidence. If fatty liver ever results from dietary deficiency of lipotropic factors in man, it might be expected in kwashiorkor.

Fourteen children with kwashiorkor were admitted to the metabolic ward. (Cases requiring plasma or blood transfusion were not included.) They were rehydrated and given vitamin K_1. Percutaneous liver biopsy was done the day after admission, provided the plasma prothrombin was satisfactory. The patients were treated with fat-free, high-protein diets, vitamins (excluding lipotropic factors), minerals, penicillin and sulphadiazine, and other treatments where necessary. Venous blood was taken after an 8-hour fast the morning after admission and every 4th (or 5th) morning thereafter for 3 weeks. All the children recovered.

The liver biopsy specimens were graded independently by one of us (C.E.W.) 0 to 4+ according to the degree of fatty change present histologically. Serum lipoproteins were separated by horizontal paper electrophoresis, following the method of Anderson *et al.*,[6] but with 1% human albumin included in the buffer. The α- and β-lipoprotein bands were cut out, extracted, and cholesterol measured by the Abell-Kendall method.[6] In addition, lipoproteins were separated as described by Lees and Hatch.[7] The stained strips were examined for pre-β lipoprotein bands.

Serum was extracted with chloroform-methanol, 2:1. Phospholipids were fractionated by thin-layer chromatography on silica gel G in the solvent system chloroform-methanol-acetic acid-water, 80:30:8:4. Individual phospholipids were visualized with iodine vapour. Lecithin and sphingomyelin bands were scraped off. Phosphorus was determined by the method of Parker and Petersen.[8]

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Seven of the patients' liver biopsies showed 3+ fatty change, (the 'severe fatty liver' group); the other 7 had lesser grades of fatty change from 0 to 2+. The severe fatty liver group had significantly lower serum albumin concentration ($P < .005$). This appeared to give a better indication of severe fatty liver than clinical palpation of the liver.

All but one of the 14 cases had normal serum α-lipoprotein cholesterol concentrations before treatment. The mean values were 39 mg. on admission, 41 mg. on day 9 and 39 mg. per 100 ml. at recovery on day 18. The one child whose initial serum α-lipoprotein cholesterol was subnormal had the lowest admission serum albumin of all the cases. Double α-lipoprotein bands were seen in the first sera from some cases.

By contrast, the serum β-lipoprotein cholesterol averaged 60 mg. before treatment, rose to a peak value of 148 mg. at day 9 and settled at 116 mg. per 100 ml. on recovery. All 14 cases showed low initial values and a peak during treatment compared with their final β-lipoprotein cholesterol values. During treatment, β-lipoprotein cholesterol showed a significantly lower peak in the cases with severe fatty liver. With the Lees and Hatch electrophoresis method, distinct pre-β lipoprotein bands were seen to appear during treatment.

Serum total phospholipids followed the same pattern as β-lipoprotein cholesterol: 136 mg. on admission, 220 mg. on day 9 and 187 mg./100 ml. at recovery. On day 1, lecithin made up 59% of the phospholipids—a percentage indistinguishable from 60% in 10 normal adults. During treatment the percentage of lecithin remained approximately constant and it was 58% at recovery. The absolute concentration of lecithin and the total phospholipids reached a higher peak (on day 9) in the group with severe fatty liver.

Our results are compatible with the decreased lipoprotein protein synthesis hypothesis if we postulate that β-lipoproteins are much more sensitive to dietary protein deficiency than α-lipoprotein. It is suggested that the maintenance of the percentage of lecithin in serum phospholipids is a point against the lipotropic factor deficiency hypothesis.

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DEFECTIVE PACKAGING MATERIAL IN STERILE SURGICAL KITS

The United States Food and Drug Administration advises that the Sterilon Corporation, 500 Northland Avenue, Buffalo, New York, is recalling its sterile surgical aids (catheters, intravenous feeding sets, and disposable scalpels) which were packaged before December 1965. The packaging material used up to that time has been found to be defective after prolonged storage, and the possible contamination of the contents would be a serious health hazard.

The Sterilon Corporation sent recall letters to all of its customers who may have received any of the suspect lots, including foreign consignees. Because of the serious hazard to health which could develop if defective package seals lead to contamination of the contents with pathogenic bacteria, the United States Food and Drug Administration has requested that it be made known that the following shipments of the suspect materials were made to a South African firm—Glaxo-Allenburys (SA) (Pty) Ltd.:

On 22 July 1965, 3 dozen each of 117-14 catheters, lot no. 18002, and 117-18 catheters, lot no. 18695. On 9 March 1965, 2 dozen each of 155-18, 155-20 and 155-22 catheters, lot no. 18517.