Sialic Acid Is a Predictor of Cardiovascular Complications in Renal Transplantation Recipients

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Fig. 1. SSA levels in the RTR group (W) and the control group (®). calculated creatinine clearance ($r = -0.107$) was found. More significant is the fact that 3 patients had an atherosclerotic vascular complication (1 stroke, 2 acute myocardial infarctions) 5-8 months after the study was done, and these 3 patients were in the 95th percentile of SSA level in the RTR group (SSA levels: 97, 97 and 105 mg/dl, respectively).

Higher levels of SSA in RTR than in controls might be explained because of their lower renal function, but the lack of a clear correlation between SSA and creatinine or calculated creatinine clearance is against this hypothesis. We cannot exclude that SSA lev-

Dear Sir,

Recently, Lindberg et al. [1] have identified a positive association between serum sialic acid (SSA) concentration and mortality from cardiovascular disease in a general population. Sialic acid is bound to the nonreducing end of carbohydrate chains of glyco-proteins and glycolipids. Some of these are called acute phase reactants and such substances rapidly increase in concentration after the onset of an inflammatory reaction or injury [2]. Although the cause of the association between SSA and mortality from cardiovascular disease is not known, a possible explanation of this fact is that SSA concentration may reflect the existence or the activity of an atherosclerotic process [1].

We have examined SSA concentration [3] in a group of 87 renal transplant recipients (RTR, 57 males, 30 females, age 40 ± 12.4 , mean $\pm$ SD, years, time since transplantation more than 6 months, creatinine level $132 \pm 59.2 \mu\text{mol/l}$) treated with conventional therapy (prednisone, azathioprine and/or cyclosporin) and we have compared them with a group of 41 healthy subjects (29 males, 12 females, age 43 ± 13.8 years).

SSA levels were higher in the RTR group in comparison with the control group (77 ± 10.5 mg/dl, range 55-105, versus 66 ± 9.3 mg/dl, range 44-81; $p < 0.001$, Mann-Whitney test), and

33% of the RTR were off-range of the control group SSA levels (fig. 1). No linear correlation between SSA levels and serum creatinine concentration ($r = 0.090$) or

41-51 52-61 62-71 72-81 82-91 92-101 102-III

SSA levels mg/dl

el, as a marker of acute phase reactants, reflected an inflammatory process localized in the graft, although time since transplantation was more than 6 months in all RTR, and there was no rejection evidence in any of them. Since cardiovascular disease is a major cause of morbidity and mortality in RTR, a tentative hypothesis is that high SSA levels in RTR reflect the increased incidence of atherosclerotic disease in this population. This hypothesis is supported by the finding that in other populations with a high incidence of atherosclerotic disease such as diabetes, SSA levels have been found higher than in non-

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Radhakrishnamurthy B, Berenson GS, Par-gaonkar PS, et al: Serum free and protein-bound sugars and cardiovascular complications in diabetes mellitus. *Lab Invest* 1976;34:159-165. diabetic subjects [4] and in subjects with diabetic microangiopathies or macroangiopathies rather than in diabetic subjects with no complications [5]. The fact that the 3 patients who suffered a cardiovascular complication were at the top range of SSA levels support Lindberg's [1] hypothesis that SSA levels reflect the activity of an atherosclerotic process and at least in RTR, high SSA levels might be a predictor of advanced atherosclerotic vascular disease. Very high SSA levels might indicate an impending acute cardiovascular complication and the need for an aggressive treatment of the risk factors for atherosclerotic cardiovascular disease in RTR.

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