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LETTERS TO EDITOR

GLUCOSE-CONTAINING ORGAN PRESERVATION SOLUTIONS AND INTRACELLULAR ACIDOSIS

We read with interest the excellent review by Belzer and Southard (*1*) on the principles of organ preservation by cold storage following vascular flushing. The UW solution developed by the authors holds the promise that improved preservation will be achieved, especially for organs other than the kidney, both in duration of safe storage and in quality of function in the early postreimplantation phase. One concept that we would like to question, however, is the view that glucose present in the preservation solution (as in EuroCollins') can contribute to the developing acidosis during hypothermia, particularly in the liver. We have been undertaking ^{31}P NMR spectroscopy studies on the response of liver to vascular flush and cold storage, using the conventional hypertonic citrate solution (which contains no glucose) and Collins' solution (a phosphate-based solution with high glucose content) (*2, 3*). Using the chemical shift of the inorganic phosphate signal, we have followed the pH changes in the livers with time at hypothermia. In these experimental studies on the rat it is apparent that the pH fall in both solutions is identical (reaching by 8 hr pH 6.85±0.04 in citrate-flushed organs, and 6.86±0.03 in Collins'-flushed organs). Factors other than lactate accumulation can influence intracellular pH, including the hydrolysis of ATP, which liberates protons (*5*)—and from our studies we have no reason to implicate glucose contained in the storage solution as a major contributing factor in the hepatic acidosis. Indeed, in other studies (to be reported) when we used a phosphate-based preservation solution in which the glucose was completely replaced by mannitol, the intrahepatic pH fall was again identical to that seen in the glucose-containing medium. The metabolic pathways in play during hypothermia of mammalian cells still remain largely to be identified, and the interesting combinations of solutes in the solution developed by Belzer and Southard open up exciting new possibilities for organ preservation.

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REFERENCES

1. Belzer FO, Southard J. Principles of solid-organ preservation by cold storage. Transplantation 1988; 45; 673.
2. Busza AL, Fuller BJ, Proctor E, Gadian DG. The time course of changes in liver phosphorus metabolites during hypothermic preservation measured by ^{31}phosphous nuclear magnetic resonance. Cryo-Letters 1988; 9: 200.
3. Fuller BJ, Busza AL, Proctor E, Myles M, Gadian DG, Hobbs KEF. Control of pH during hypothermic liver storage: role of the storage solution. Transplantation 1988; 45: 239.
4. Rouslin W, Erickson J, Solaro R. Effect of oligomycin and acidosis on rates of ATP depletion in ischemic heart muscle. Am J Physiol 1986; 250: H503.

PRESERVATION OF LIVERS WITH UW OR EURO-COLLINS' SOLUTION

Beginning in October 1987, we have used the preservation solution developed for livers by Jamieson (*1*), Kalayoglu (*2*), and Belzer and their associates at the University of Wisconsin (UW). The first 185 livers were preserved for an average of 10.1±5 (SD) hr (range 4 to 24 hr). The results were compared with those obtained with Euro-Collins' solution in the preceding 180 livers, which were preserved for 5.9±1.4 hr (range 3.5–9.5). The most meaningful data were from 151 primary transplantations in the UW group and from a comparable 144 primary transplantations in the Euro-Collins' group.

In spite of the longer preservation, the UW livers performed at least as well as those preserved with Euro-Collins. The UW organs survived at 3 months at a higher rate (76% versus 68%); permitted a better 3-month patient survival (83% versus 81%); and had a lower rate of primary nonfunction, a reduced need for retransplantation (17 versus 29), and a lowered incidence of the hepatic artery thrombosis (8 versus 19) which has been most common in infants and small children. With the UW solution, there was no correlation between the time of preservation up to 24 hr and liver function abnormalities during the first postoperative week (Fig. 1).

The remarkable effectiveness of the UW solution has changed many aspects of liver transplantation. The longer safe preservation time has permitted more effective use of organs that can be stored while awaiting for operating room facilities or personnel to become available. It has allowed procurement of grafts from cities once considered to be too distant. It has taken the stress from the recipient operation and allowed more deliberate hepatectomy techniques. Since formal analysis of our first 185 cases, these conclusions have been strengthened by experience with another 250 liver preservations with a maximum cold ischemia time of 35 hr with success.

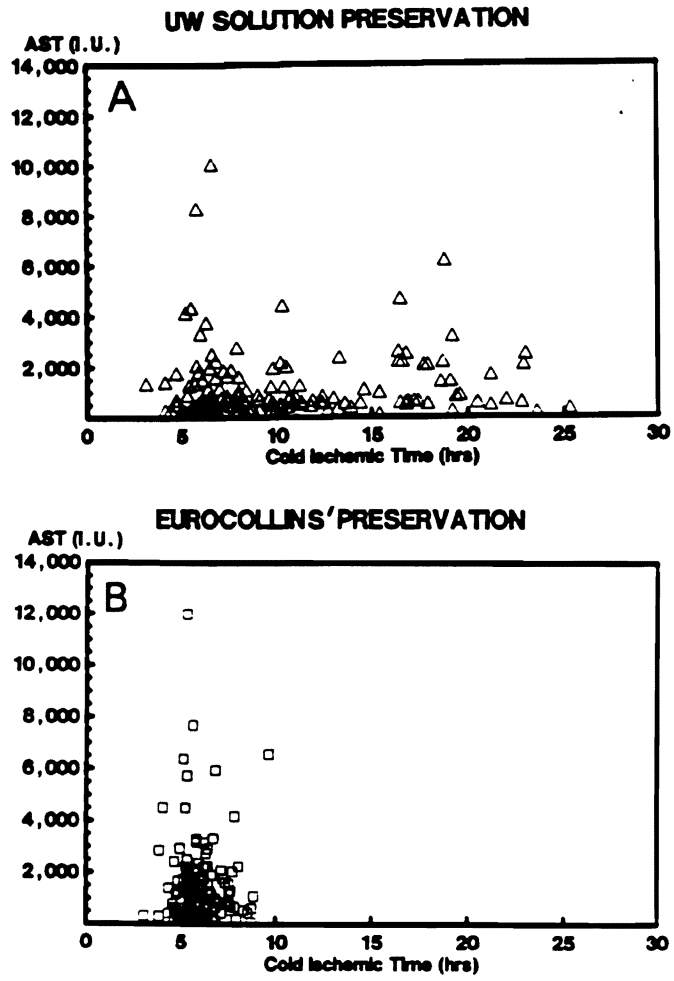

FIGURE 1. Highest serum aspartate aminotransferase (AST) in the first week from livers preserved with UW solution (A) versus Euro-Collins' solution (B).

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REFERENCES

1. Jamieson NV, Sundberg R, Lindell S, et al. Successful 24- to 30-hour preservation of the canine liver: a preliminary report. Transplant Proc 1988; 20: 945.
2. Kalayoglu M, Sollinger WH, Stratta RJ, et al. Extended preservation of the liver for clinical transplantation. Lancet 1988; 1: 617.

HEPATITIS IN LIVING-DONOR RENAL ALLOGRAFT RECIPIENTS

The effect of liver disease on the survival of renal allograft recipients is still controversial (*1–5*). We have therefore reviewed our experience with hepatitis in such patients.

All 447 patients who had living-donor kidney transplantation at our center from 1976 to 1985 were studied. Donor selection, immunosuppression regimen, and transfusion protocol have been reported earlier (*6–8*). Liver function tests and screening for hepatitis B surface antigen (HBsAg) were done at monthly intervals, or more frequently if necessary, up to 6 months after transplantation, and at frequent intervals thereafter. Serum was examined for HbsAg by the reverse passive hemagglutination test. Liver biopsies were performed when indicated.

Hepatitis was defined as a two-fold elevation of serum aspartate aminotransferase or serum alanine aminotransferase, or both, with or without an increase in serum bilirubin. Chronicity was defined as persistence of hepatitis for more than 6 months.

A total of 66 (14.8%) of the patients had hepatitis. All had received azathioprine, and 11 also received potentially hepatotoxic drugs such as rifampicin, isoniazid, pyrazinamide, and alpha methyldopa. The mean follow-up was 17 months (range 6–74 months), during that period 35 of the 66 patients (53%) had chronic hepatitis and the rest transient hepatitis.

Of the 35 with chronic hepatitis, 16 had persistent HBs antigenemia, 6 transient antigenemia, and the rest were always negative on HBsAg testing. Four patients with chronic hepatitis who had severe disease had liver biopsies that showed chronic active hepatitis in 2, micronodular cirrhosis in 1, and hemosiderosis in 1. Five patients with chronic hepatitis and persistent antigenemia died of hepatocellular failure, and another died of gram-negative bacterial septicemia. One patient with chronic hepatitis and transient antigenemia died of hepatocellular failure, 2 of gram-negative bacterial septicemia, 2 of severe bacterial respiratory infection, and 2 of disseminated tuberculosis.

Of the 31 with transient hepatitis, 6 had persistent HBs antigenemia, 16 transient antigenemia, and the rest were always negative on HBsAg testing. Liver biopsy of two patients