

Metabolic and Immunohistochemical Assessment of Endocrine Pancreatic Function After Orthotopic Multivisceral Transplantation

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IT is well known that pancreatic allografts normalize hyperglycemia a few hours after reperfusion.¹ Endocrine function has been intensively studied in pancreas allografts from a biochemical point of view.² Outstanding among functional studies is intravenous (IV) glucagon test,³ which has rarely been used in pancreas transplantation.⁴ However, there is little information on early histochemical aspects of pancreas transplantation and endocrine function has not been properly studied in multivisceral transplantation with the pancreas allograft draining into the portal vein of the liver graft. We studied the endocrine function of the orthotopically transplanted pancreas after multiorgan procurement in a multivisceral transplantation model in a previously reported model.⁵

ANIMALS AND METHODS

The liver, pancreas, and duodenum were harvested from pigs, with a conventional technique and cold Euro-Collins solution. An orthotopic en bloc allotransplantation of these organs was performed with a short cold ischemia time (under 3 h).⁵ Serum glucose was monitored hourly for the first 10 postoperative hours and every 6 hours thereafter. Pancreatic tissue was taken at necropsy, for Hematoxylin-Eosin and immunohistochemical studies (anti-insulin and anti-glucagon antibodies, Milab B39-100, B31-100). The number of functional islets of Langerhans were counted in 25 microscopy fields ($\times 160$). Healthy pigs ($n = 6$) were used as a control group for immunohistochemistry. An IV glucagon test was performed in transplanted and in the control group animals.

RESULTS AND DISCUSSION

Thirty-six transplants were performed with survival of the pig after the operation. Animals surviving over 1 day were 14. Only 2 of the 22 animals surviving less than 24 hours died from primary non-function (diabetic coma and necrotic acute pancreatitis). Serum amylase at the end of the operation was under 3000 IU/L; amylase was over 4000 IU/L only in three pigs and they showed moderate to severe acute pancreatitis: two suffered warm ischemia. Serum

glucose 8 hours posttransplant was within normal limits in all animals except one. Immunohistochemical study was performed in five transplanted animals at necropsy (survival 12, 12, 24, 24, 60 h). When compared to the control group, there was no statistically significant difference in the number of islets identified with anti-Insulin antibodies (57 ± 45 versus 54 ± 47 ; $P = .91$) nor with anti-glucagon antibodies (15 ± 16 versus 13 ± 9 ; $P = .83$). An IV glucagon test was performed on six transplanted animals at 4 and 7 postoperative hours and 1, 2, and 10 postoperative days; there was no statistical difference with the control group (fasting insulinemia [$\mu\text{U/mL}$], 9 ± 6 versus 11 ± 7 for control group; 6' insulinemia, 18 ± 12 versus 36 ± 15 for control group) ($P = .078$), specially if it was done at least 24 hours posttransplant ($P = .28$). Multiorgan procurement seems to be a proper technique to preserve early endocrine pancreatic function. Hyperinsulinemia was not found in this orthotopic pancreas transplantation, as has been previously described in pigs.⁶

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