Pancreatic Preservation in a Multiorgan Procurement Procedure and Transplantation

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MULTIORGAN harvesting for individual organ transplantation is well defined according to the principles of Starzl.[1] However, some pancreatic transplant surgeons believe the pancreas should not suffer hyperperfusion as occurs in multiorgan harvesting.[2] This is in conflict with the need of all donor organs for transplantation and specially when multivisceral transplantation is planned. We believe that the pancreas is not so sensitive to high-volume flushing: most pancreata are harvested from multiorgan donors with good functional results.[3] Even when flushing to the pan-creas in the adult donor is only 2 L, severe allograft pancreatitis has been reported in multivisceral transplantation.[4] There must be some other etiologic factors of pancreatic preservation injury, namely warm ischemia[5,6] and preservation time.[7] We studied the quality of pancreas preservation in a multiorgan conventional preservation and orthotopic multivisceral transplantation technique.

ANIMALS AND METHODS

The liver, pancreas, and duodenum we harvested from pigs (20–35 kg), using a high volume (3 L) of cold Euro-Collins solution (80–120 mL/kg) via the abdominal aorta with a high perfusion pressure (50 mm Hg). An orthotopic en bloc allotransplantation of these organs was performed in pigs (cold ischemia time under 3 hours).[8] In order to study pancreatic function, glucose was monitored hourly along the first 10 postoperative hours and every 6 hours thereafter; serum amylase was measured 1, 6, 24, 48, and 72 hours postreperfusion when alive. Pancreatic tissue was taken at necropsy for immunohistochemical (anti-Factor VIII antibodies) and hematoxylin-eosin study. Pancreatic inflammation was looked for and classified as grade I (isolated foci of necrosis), grade II (small foci of necrosis in 50% of pancreatic lobes), or grade III (major areas of pancreatic necrosis). A control group of pigs (n = 5) was used to test serum amylase and immunohistochemistry: the percentage of vessels identified with anti-Factor VIII antibodies was counted.

RESULTS

Thirty-six transplants were performed with survival of the pig after the operation, 2 of them with a short period (5–20 minutes) of pancreatic warm ischemia due to technical complications. Fourteen animals survived for more than 1 day. Only 2 of the 22 animals surviving less than 24 hours died from primary nonfunction (diabetic coma and necrotic acute pancreatitis). Clinicopathologic aspects of liver and duodenal preservation have been previously reported.9,10 Serum amylase at the end of the operation was 2853 ± 4438 IU/L if an animal suffering severe acute pancreatitis is excluded; amylase was over 4000 IU/L only in three pigs and they showed acute pancreatitis grade II or III: two of them suffered warm ischemia. The maximum level of serum amylase was on postoperative day 2 (5071 IU/L). Serum glucose level 8 hours posttransplant was within normal limits in all animals except one. There was no statistical difference in the percentage of vessels identified with anti-Factor VIII antibodies between five transplanted animals (72% ± 9) (survival: 12, 12, 24, 24, 60 hours) and the control group (77% ± 3) (P = .24). The percentage of pancreatic preservation lesions is summarized in Table 1.

DISCUSSION

This high volume-high pressure perfusion technique seems to be adequate to preserve the pancreas when the grade of inflammation, levels of serum amylase, and microcirculation are assessed in the very early postoperative period. Results were better than those obtained by other authors[11] with Euro-Collins in swine pancreas transplantation. Warm ischemia to the pancreas allograft correlated with moderate to severe acute pancreatitis. This issue, together with prolonged cold ischemia time[4] and surgical manipulation of the graft, is probably responsible for severe acute pancreatitis. Immunohistochemical study of microcirculation with antiFactor VIII antibodies correlated well with conventional parameters of pancreatic preservation injury. These techniques, largely used now as prognostic factors of tumoral angiogenesis,[12] could be clinically used in human pancreatic transplantation in order to compare preservation techniques and clinical results.

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Table 1. Pancreatic Preservation Lesions (%) Found in Surviving Animals

	None	Grade I	Grade II	Grade III
Survival <24 h (n = 22)	73	14	4	9
Survival 1–4 d (n = 11)	55	36	9	0
Survival >4 d (n = 3)	100	0	0	0