Persufflation Improves Pancreas Preservation When Compared With the Two-Layer Method

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ABSTRACT

Islet transplantation is emerging as a promising treatment for patients with type 1 diabetes. It is important to maximize viable islet yield for each organ due to scarcity of suitable human donor pancreata, high cost, and the large dose of islets required for insulin independence. However, organ transport for 8 hours using the two-layer method (TLM) frequently results in low islet yields. Since efficient oxygenation of the core of larger organs (eg, pig, human) in TLM has recently come under question, we investigated oxygen persufflation as an alternative way to supply the pancreas with oxygen during preservation. Porcine pancreata were procured from donors after cardiac death and preserved by either TLM or persufflation for 24 hours and subsequently fixed. Biopsies collected from several regions of the pancreas were sectioned, stained with hematoxylin and eosin, and evaluated by a histologist. Persufflated tissues exhibited distended capillaries and significantly less autolysis/cell death relative to regions not exposed to persufflation or to tissues preserved with TLM. The histology presented here suggests that after 24 hours of preservation, persufflation dramatically improves tissue health when compared with TLM. These results indicate the potential for persufflation to improve viable islet yields and extend the duration of preservation, allowing more donor organs to be utilized.

ISLET TRANSPLANTATION is emerging as a promising treatment for patients with type I diabetes.[1,2] The minimally invasive nature of the procedure as well as the islets' intrinsic ability to tightly control blood glucose levels on demand via insulin release, offer a combination of advantages that cannot be matched by other presently available treatments, such as self-monitoring or whole-organ pancreas transplantation. Despite recent advances building upon the Edmonton Protocol[3] published in 2000, most centers still require multiple transplants to achieve long-term diabetes reversal.[4] The large dose of islets required, the high cost of the isolation process, and a shortage of suitable donor pancreata demand that we maximize the viable islet yield from each available organ.

A lack of proper oxygenation during preservation places hypoxic or anoxic stress on the tissue and may predispose islets to death during the isolation process.[5–8] It has been postulated that improving pancreas preservation via enhanced oxygenation may (1) extend the effective duration of preservation, (2) expand the donor pool up to 10-fold, (3) reduce the immunogenicity of transplanted islets, and (4) reduce the number of donors needed per patient.[9] Presently, the two-layer method (TLM) is the state of the art for pancreas preservation. TLM involves suspending the pancreas between cold preservation solution and a preoxygenated perfluorochemical with the goal to improve oxygen-

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Research funding provided by a grant from the National Center for Research Resources (U42 RR016598), National Institutes of Health (NIH), National Institute of Diabetes and Digestive and Kidney Diseases (R43 DK070400), NIH, the Schott Foundation, and the Carol Olson Memorial Diabetes Research Fund.

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0041-1345/10/$–see front matter
doi:10.1016/j.transproceed.2010.05.092

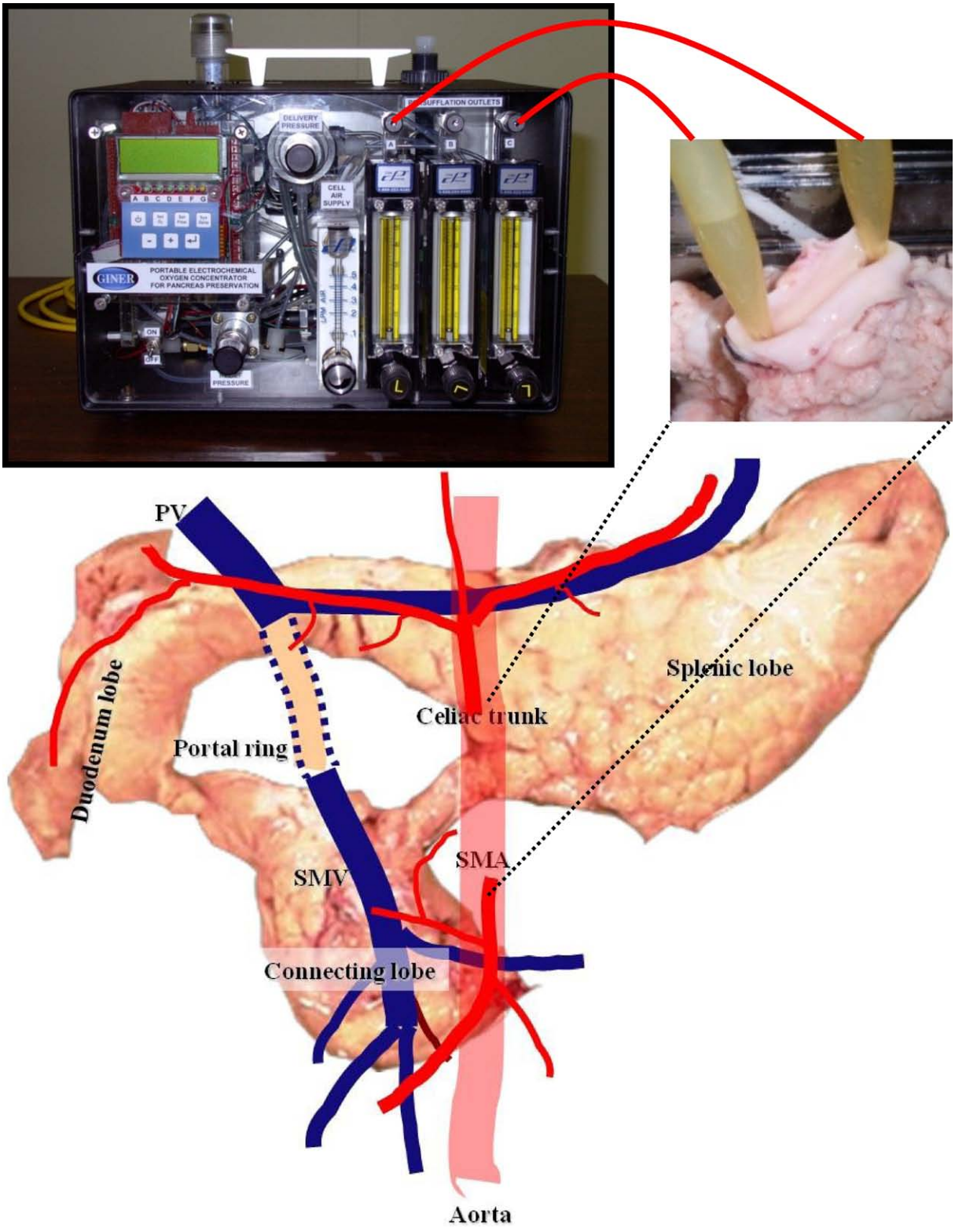

Fig 1. Schematic illustrating how the organs were persufflated starting with the electrochemical oxygen concentrator and showing the paths taken by the gas upon entering the organ via celiac trunk and superior mesenteric artery (SMA) until exiting the organ via the portal drainage system. SMV, superior mesenteric vein.