Pancreatic Transplantation

Essay

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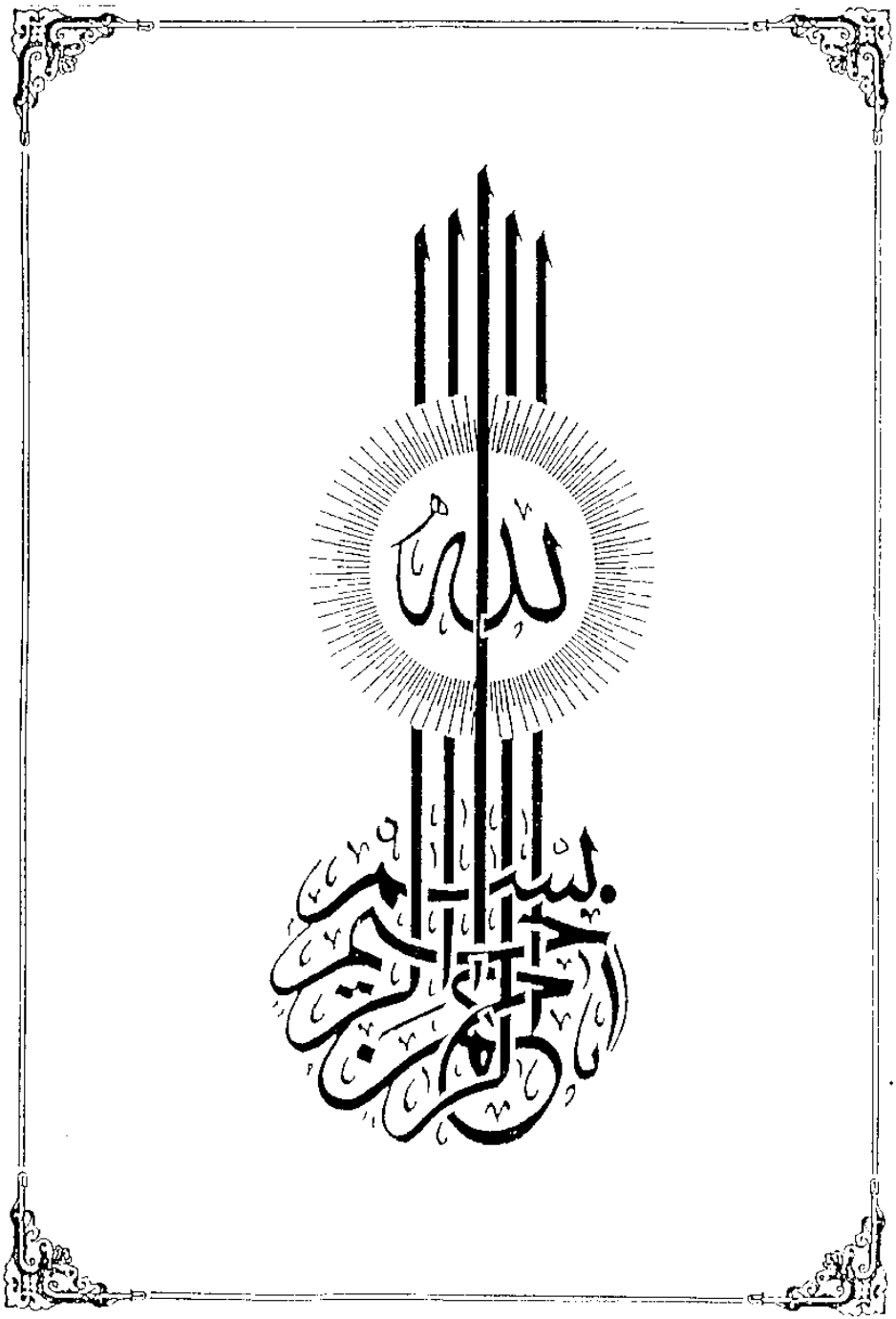
بسم الله الرحمن الرحيم

وما أوتيتم من العلم إلا قليلاً

صدق الله العظيم



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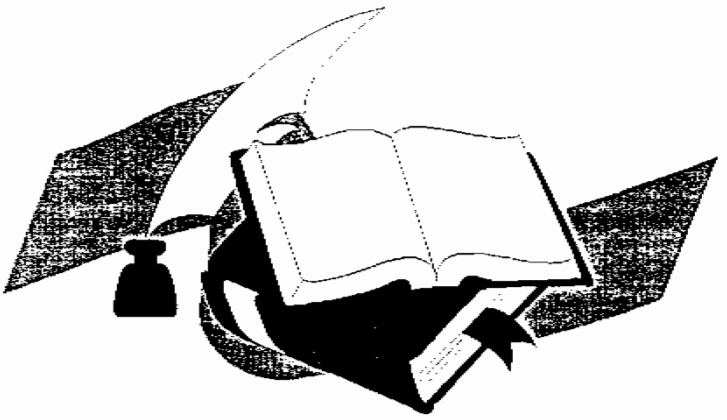
Contents



Introduction

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The incidence of diabetes mellitus is approximately 5% of the general population. Insulin-dependent diabetes occurs in one fourth and noninsulin-dependent diabetes occurs in three fourths of patients.

Diabetes mellitus is characterized by disordered carbohydrate metabolism and by microvascular complications including retinopathy, nephropathy, neuropathy, and peripheral vascular disease which lead to significant morbidity and mortality in many individuals.

Treatment of diabetes is primarily insulin replacement by multiple subcutaneous injections, continuous subcutaneous infusion, or continuous intravenous infusion via insulin pumps located externally or implanted subcutaneously. The administration of exogenous insulin has not been shown to restore metabolic homeostasis adequate to prevent the secondary complications of diabetes. Clinical and experimental studies support the hypothesis, however, that restoration of a constant euglycemic state will prevent the occurrence or halt the progression of these complication.

In 1967, *Kelly and co-workers* showed that pancreas transplantation in patients with type I diabetes was technically feasible and could restore blood glucose levels to normal.

Then the patient and graft survival has continued to improve over the years.

Additionally new techniques have been developed to decrease complications and enhance the ability to monitor rejection.

It has become apparent that the patient and graft survival are improved when a simultaneous pancreas kidney transplantation is performed.

The aim of this essay is to review the whole subject with special emphasis on biological basis of both pancreas and islet cell transplantation, in addition to the anatomic, histologic aspects and complication of both procedures.

Anatomy and Embryology

Anatomy and Embryology

Embryology

The pancreas develops from ventral and dorsal buds that protrude from the primitive gut below the stomach. The ventral bud appears at about the third week of gestation, originating from one or two buds of the main ventral diverticulum, which elongaties to form the liver, gallbladder, and common bile duct. The dorsal bud appears at about the fourth week of gestation from the duodenum itself. The ventral bud rotates clockwise around the duodenum to meet the dorsal bud and fuse at about the sixth or seventh week of gestation *(Skandalakis et al., 1979)*.

In adult, only the caudal portion of the head and the uncinate process are derived from the ventral pancreas. The cranial part of the head and all of the body and tail are derived from the dorsal pancreas. Most of the dorsal pancreatic duct joins with the duct of the ventral pancreas to form the main pancreatic duct *(duct of Wirsung)*; a small part persists as the accessory duct *(duct of Santorini) (Alexander, 1970)*.

In 5% - 10% of people, the ventral and dorsal pancreatic ducts do not fuse, and most regions of the pancreas drain through the duct of Santorini and the orifice of the minor papilla. In this case, only the small ventral pancreas drains with the common bile duct through the papilla of Vater *(Skandalakis et al., 1979)*.

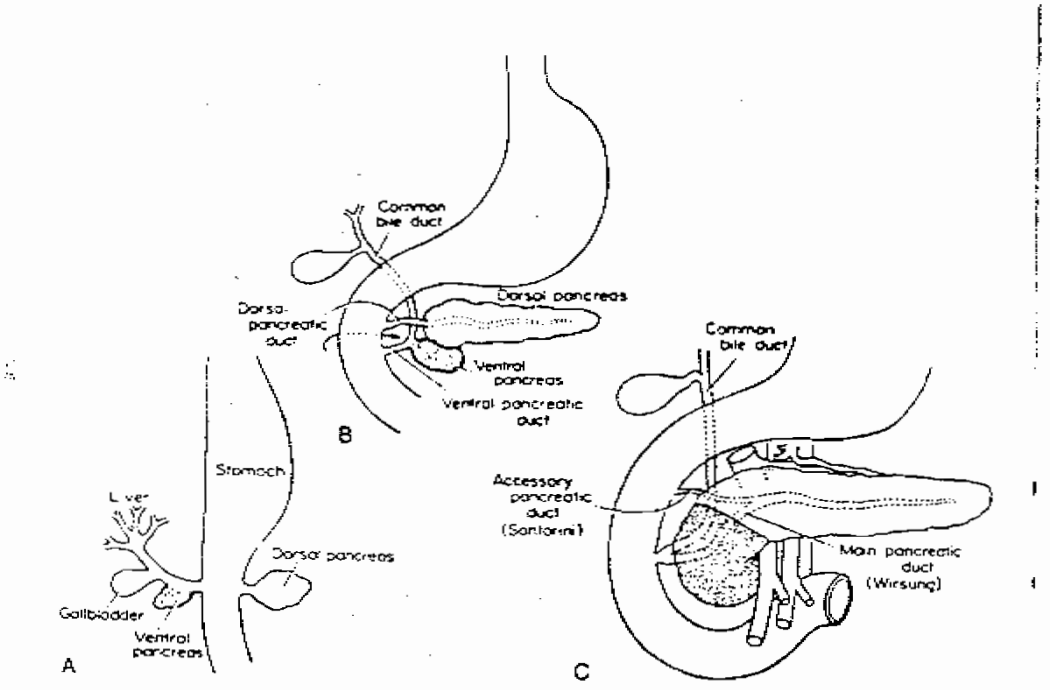

Figure 1: Embryonic development. A, Formation of dorsal and ventral pancreatic primordia. B, Rotation of the ventral pancreas. C, Fusion of the primordia to form adult pancreas *(After Skandalakis et al., 1979).*

Anatomy of the Pancreas

General

The pancreas is a soft, yellowish, elongated, hammer head-shaped organ that lies relatively fixed in the retroperitoneum behind the peritoneal floor of the lesser sac at the level of the second lumber vertebra. It extends transversely across the posterior abdominal wall from the concavity of the duodenum to the hilum of the spleen *(Schlossberg and Zuidema, 1980)*.

The pancreas is related to the duodenum, stomach, and spleen anteriorly and above, where as the duodenum, jejunum, transverse colon, and spleen are below and anterior. Also, directly anterior is the mesocolon, which is so short over the pancreatic head that it allows the colon to be in almost direct contact with the pancreatic tissue. Posterior to the pancreas are the right renal vessels, inferior vena cava, portal vein, diaphragmatic crura, aorta, celiac plexus, thoracic duct, superior mesenteric vessels, splenic vessels, left renal vessels, and left kidney.

Because of these relatively fixed structures, lesions of the pancreas tend to extend forward into the lesser sac *(Skandalakis et al., 1979)*.

Pancreas measures 15 to 20 cm in length, about 3.1 cm in width and 1 to 1.5 cm in thickness. The pancreas weighs between 80 to 90 gram. It has been divided into five general parts for descriptive purposes, without any external markings to specify these parts head, uncinate process, neck, body, and tail *(See Figure 2) (Cooperman and Steiger, 1978)*.

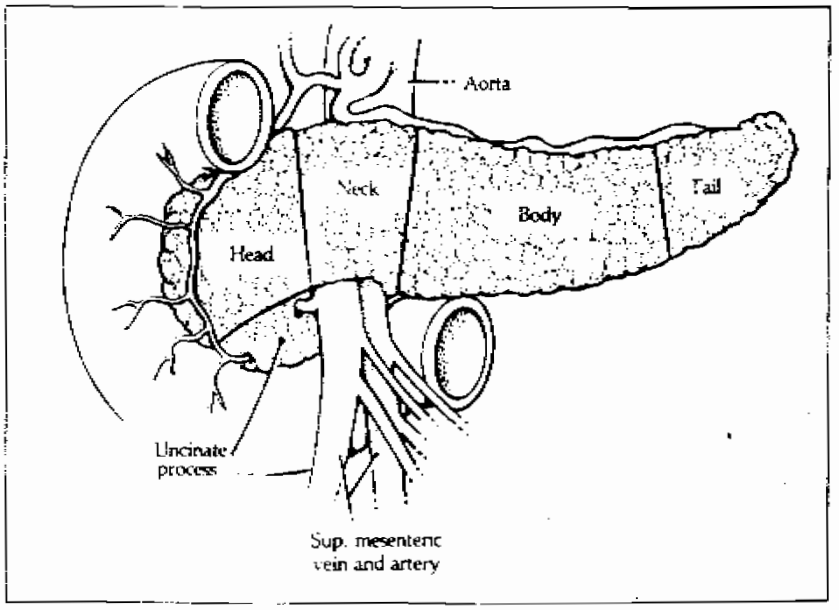

Figure 2: The five parts of pancreas *(After Skandalakis et al., 1979).*

Parts of the Pancreas

Head

The head lies just to the right of the second lumbar vertebra it is intimately cradled in the concavity of the duodenum without intervening peritoneum, thus creating a bare area on the medial aspect of the duodenum *(Skandalakis et al., 1979).*

The head of the pancreas is flattened and has an anterior and a posterior surface. The anterior surface is adjacent to the pylorus and the transverse colon. The anterior pancreatoduodenal arcade parallels the duodenal curvature and is related to the pancreatic surfaces. The posterior surface is close to the hilus and medial border of the right kidney, the right renal vessels and the inferior vena cava, the right crus of diaphragm, the posterior pancreatoduodenal arcade, and the right gonadal vein *(John et al., 1983).*

The terminal common bile duct usually passes through the substance of the pancreatic head, although in approximately 15% of people, it remains externally in a groove on the posterior aspect just before entering the descending portion of the duodenum. Hepatic or middle colic artery can also lie behind the pancreatic head as a congenital anomalous. An imaginary line joining the portal vein above and the superior mesenteric vein below marks the junction between the head and neck of the pancreas *(Skandalakis et al., 1979).*

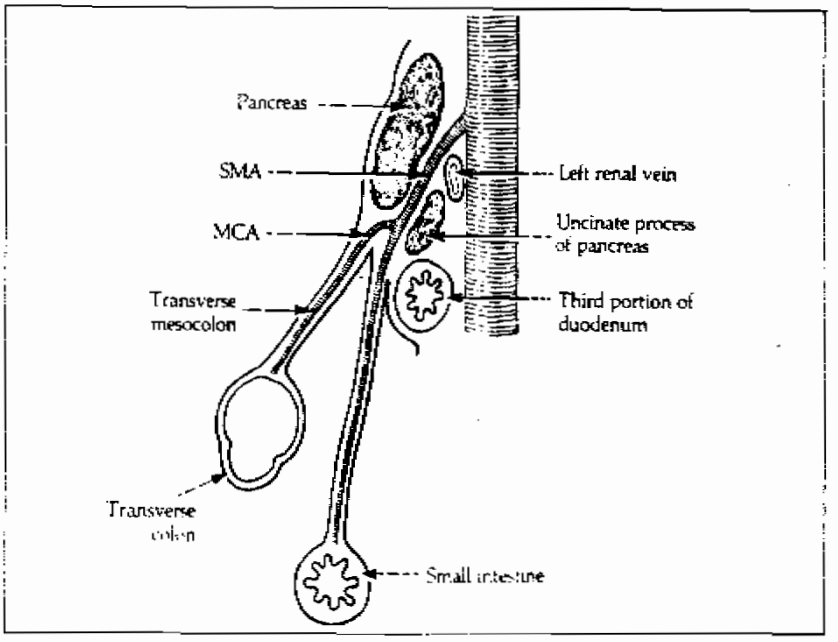

Figure 3: Diagrammatic sagittal section through the neck of the pancreas. The uncinate process and the third portion of the duodenum lie posterior to the superior mesenteric artery "SMA" and anterior to the aorta. The middle colic artery "MCA" leaves the SMA to travel in the transverse mesocolon *(After Akin et al., 1976).*