Anesthetic Considerations for Pancreatic Transplantation

An Essay

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By

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قَالُواْ سُبْحَانَكَ
لاَ عِلْمَ لَنَا إِلاَّ مَا
عَلَّمْتَنَا إِنَّكَ أَنتَ
الْعَلِيمُ الْحَكِيمُ
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Aya El-Sayed Ahmed

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List of Abbreviations

ADA	**:** American Diabetes Association
BMI	**:** Body mass index
CCK	**:** Cholecystokinin
CIT	**:** Cold ischemia time
CT	**:** Computed tomography
CVD	**:** Cardio vascular disease
CVP	**:** Centeral venous pressure
DAN	**:** Diabetic autonomic neuropathy
DN	**:** Diabetic neuropathy
DR	**:** Diabetic retinopathy
ECG	**:** Electrocardiography
ESRD	**:** End stage renal disease
GBM	**:** Glomerular basement membrane
GDM	**:** Gestational diabetes mellitus
GFR	**:** Glomerular filteration rate
GIP	**:** Gastric inhibitory polypeptide
HIV	**:** Human immunodeficiency virus
IAAs	**:** Anti insulin antibodies
IAPP	**:** Islet amyloid polypeptide
ICCA	**:** Islet cell cytoplasmic antibodies
ICSA	**:** Islet cell surface antibodies
ICU	**:** Intensive care unit
IDDM	**:** Insulin dependent diabetes mellitus
IPTR	**:** International pancreas transplant registry
IRMA	**:** Intra-retinal microvascular abnormalities
LPL	**:** Lipoprotien lipase
MMF	**:** Mycophenolate mofetil
NIDDM	**:** Non insulin dependent diabetes mellitus

List of Abbreviations *(Cont...)*

NPDR : Non proliferative diabetic retinopathy
PAK : Pancreas after kidney
PAT : Pancreas alone transplantation
PDR : Proliferative diabetic retinopathy
PP : Pancreatic polypeptide
PPARg : Peroxisome proliferators activated receptor g
RXR : Retinoid x receptor
SMVs : Superior mesenteric vessels
SPK : Simultaneous pancreas and kidney
UAE : Urine albumin excretion
VEGF : Vascular endothelial growth factor

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INTRODUCTION

Diabetes mellitus is a leading cause of morbidity and mortality worldwide, although improvements in insulin therapy have taken place, morbidity is still a reality for many patients ***(Robertson et al., 2006)***.

Pancreas transplantation was performed for the first time in human on December 1966. Over 19000 transplants have been reported to the International Pancreas Transplant Registry (IPTR), 14 000 of them being performed in the USA ***(Zielinski et al., 2003)***.

Patients prepared for pancreatic transplantation should be evaluated carefully. The assessment for each candidate should always include a thorough evaluation for end organ disease associated with diabetes, an evaluation of other preexisting comorbidities and other routine preoperative evaluation ***(Inzucchi et al., 2012).***

The patient must be thoroughly examined; particular attention should be given to metabolic, biochemical and acid–base disturbance. Those with renal failure should be dialysed to control serum urea, k^+, and creatinine , Blood is also sent to cross-matching. Evaluation of autonomic failure,

with evidence of cardiac denervation, gastroparesis and orthostatic hypotension is done ***(Bax et al., 2013).***

The primary determinants of recipient selection are the presence of diabetic complications, degree of nephropathy and cardiovascular risk. The patients should have a physiological reserve to withstand the stresses of surgery and long-term immunosuppression and be able to comply with treatments and follow-up ***(Hakim et al., 2002).***

AIM OF THE WORK

The aim of this work is to discuss the anesthetic considerations during pancreatic transplantation which is an advanced therapeutic option for patients with diabetes mellitus who require exogenous insulin.

ANATOMY AND PHYSIOLOGY OF THE PANCREAS

The pancreas is divided into four parts: head, neck, body and tail, and it possesses one accessory lobe (the uncinate process). The division into the parts is purely on the basis of anatomical relations and there are only very minor functional or anatomical differences between them ***(Jeremiah and Neil, 2008).***

In an adult, the pancreas weighs 75 to 100 g and is about 15 to 20 cm long ***(William et al., 2010)***. With age, the amount of exocrine tissue tends to decline, as does the amount of fatty connective tissue within the substance of the gland, and this leads to a progressive thinning atrophy which is particularly noticeable on CT ***(Neil et al., 2005)***.

The pancreas lies within the curve of the first, second and third parts of the duodenum, and extends transversely and slightly upwards across the posterior abdominal wall to the hilum of the spleen, behind the stomach. It does not lie in one plane but is effectively ‘draped' over the other structures in the retroperitoneum and the vertebral column and so forms a distinct shallow curve, of which the neck and medial body are the most anterior parts. Because of its flattened shape, the parts of the pancreas, particularly the body, are often referred to as having surfaces and borders ***(Susan, 2008).***

Regions of the Pancreas:

a. Head of the Pancreas:

The head of the pancreas lies to the right of the midline, anterior and to the right side of the vertebral column. It is the thickest and broadest part of the pancreas. It lies within the curve of the duodenum. Superiorly it lies adjacent to the first part of the duodenum but close to the pylorus. The duodenal border of the head is flattened and slightly concave. Occasionally a small part of the head is actually embedded in the wall of the second part of the duodenum. The superior and inferior pancreaticoduodenal arteries lie between the head and the duodenum in this area. The inferior border lies superior to the third part of the duodenum and is continuous with the uncinate process. Close to the midline; the head is continuous with the neck. The boundary between head and neck is often marked anteriorly by a groove for the gastroduodenal artery and posteriorly by a similar but deeper deep groove containing the union of the superior mesenteric and splenic veins to form the portal vein ***(Susan, 2008)***.

The anterior surface of the head is covered with peritoneum and is related to the origin of the transverse mesocolon ***(Jeremiah and Neil, 2008)*.**

The posterior surface of the head is related to the inferior vena cava, which ascends behind it and covers almost all of this aspect. It is also related to the right renal vein and the right crus of the diaphragm ***(Jeremiah and Neil, 2008).***

b. Neck of the Pancreas:

The neck of the pancreas links the head and body. It is often the most anterior portion of the gland. It is defined as that portion of the pancreas which lies anterior to the portal vein. The lower part of the neck lies anterior to the superior mesenteric vein just before the formation of the portal vein. This is important during surgery for pancreatic cancer since malignant involvement of these vessels may make resection impossible ***(Neil et al., 2005)***.

At its superior border, it is adjacent to the celiac axis with the hepatic artery to the right and the splenic artery just to its left. Just posterior to the neck, lies the confluence of the splenic and superior mesenteric vessels (SMVs), which arise form the portal vein. In this area, rarely when there are any anterior branches to the body of the pancreas. Therefore, during a pancreaticoduodenectomy, this plane can be developed with limited risk of vessel perforation or tributaries interfering with the process ***(Selwyn et al., 2006).***

c. Body of the Pancreas:

The body of the pancreas runs from the left side of the neck to the tail. It is the longest portion of the gland and becomes progressively thinner and less broad towards the tail. It is slightly triangular in cross-section and is described as having three surfaces: anterosuperior, posterior and anteroinferior and having three borders: Superior border, Anterior border and Inferior border ***(Susan, 2008)***.

The anterosuperior surface of the pancreas (Fig.1) makes up most of the anterior aspect of the gland close to the neck. Laterally, it narrows and lies slightly more superiorly to share the anterior aspect with the anteroinferior surface. It is covered by peritoneum, which runs anteroinferiorly from the surface of the gland to be continuous with the anterior, ascending layer of the greater omentum. It is separated from the stomach by the lesser sac ***(Jeremiah and Neil, 2008)*.**

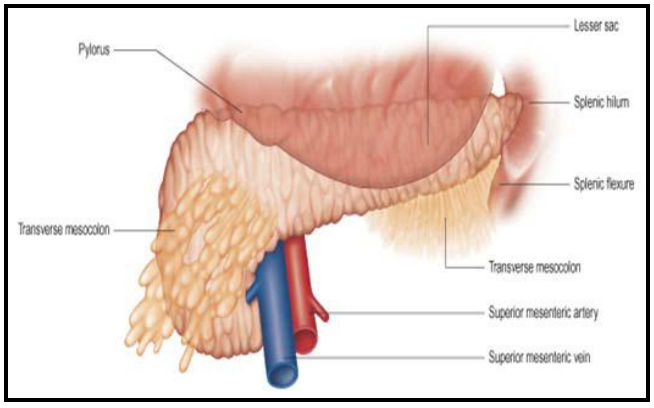

Figure (1): Anterior relations of the pancreas
(Jeremiah and Neil, 2008).

The posterior surface of the pancreas (Fig.2)is devoid of peritoneum. It lies anterior to the aorta and the origin of the superior mesenteric artery, the left crus of the diaphragm, left suprarenal gland and the left kidney and renal vessels, particularly the left renal vein. It is closely related to the splenic vein which runs from left to right forming a shallow groove in the gland. The splenic vein lies between the posterior surface and the other posterior relations. The left kidney is also separated from the posterior surface by perirenal fascia and fat ***(Jeremiah and Neil, 2008).***

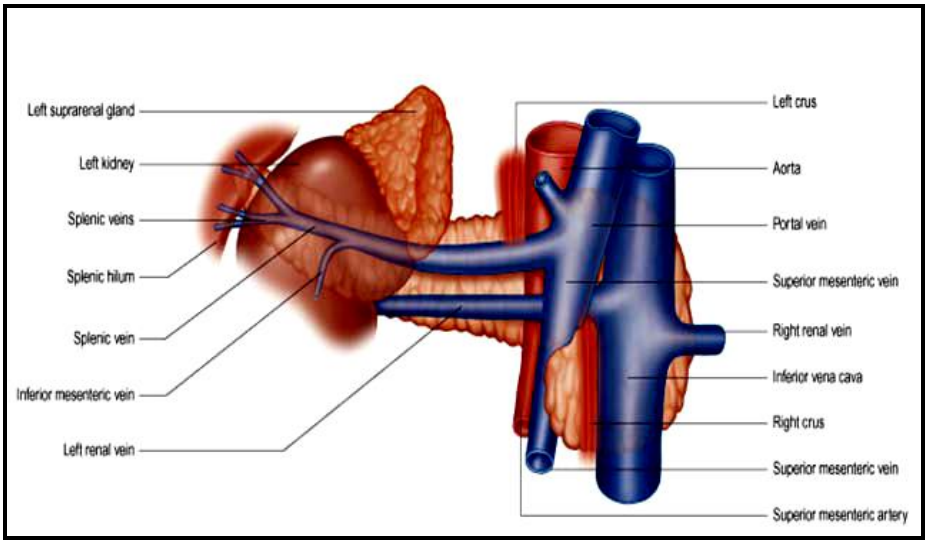

Figure (2): Posterior relations of the pancreas. The posterior surface of the pancreas with its relations (viewed from behind) ***(Jeremiah and Neil, 2008)***.

The anteroinferior surface of the pancreas begins as a narrow strip just to the left of the neck. As the body runs laterally, it broadens out to form more of the anterior aspect of