ANATOMY AND PHYSIOLOGY Anatomy

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The name ‘pancreas’ is derived from the Greek ‘pan’ (all) and ‘kreas’ (flesh). For a long time, its glandular function was not understood and it was thought to act as a cushion for the stomach. The pancreas is situated in the retroperitoneum. It is divided into a head, which occupies 30% of the gland by mass, and a body and tail, which together constitute 70%. The head lies within the curve of the duodenum, overlying the body of the second lumbar vertebra and the vena cava. The aorta and the superior mesenteric vessels lie behind the neck of the gland. Coming o ff the side of the pancreatic head and passing to the left and behind the superior mesenteric vein is the uncinate process of the pancreas. Behind the neck of the pancreas, near its upper border, the superior mesenteric vein joins the splenic Paul Langerhans , 1847–1888, Professor of Pathological Anatomy , Freiberg, Germany vein to form the portal vein (Figures 72.1 and 72.2). The tip of the pancreatic tail extends up to the splenic hilum. The pancreas weighs approximately 80 /uni00A0 g. Of this, 80–90% is composed of exocrine acinar tissue, which is organised into lobules. The main pancreatic duct branches into interlobular and intralobular ducts , ductules and, finally , acini. The main duct is lined by columnar epithelium, which becomes cuboi - dal in the ductules. Acinar cells are clumped around a central lumen, which communicates with the duct system. Clusters of endocrine cells, known as islets of Langerhans, are distributed throughout the pancreas. Islets consist of di ff er ent cell types: 75% are B cells (producing insulin); 20% are A cells (producing glucagon); and the remainder are D cells (producing soma - tostatin) and a small number of pancreatic polypeptide cells. Within an islet, the B cells form an inner core surrounded by the other cells. Capillaries draining the islet cells drain into the portal vein. There are nine key processes that occur during pancreatic embr yogenesis (Table 72.1). Malrotation of the ventral bud in the fifth week results in an annular pancreas, while the mode of , described the islets in 1869, in his doctoral thesis.

Splenic artery Splenic Left Inferior vein kidney vena cava Spleen Aorta Portal vein Right kidney Left re nal vessels Right Inferior re nal Right mesenteric vessels ureter Left vein Superior ureter mesenteric vein Figure 72.1 The posterior relations of the pancreas. Assessment and management of pancreatitis • Diagnosis and treatment of pancreatic cancer • Pancreatoduodenal artery Head Neck Ta il Body Superior mesenteric artery Uncinate Superior mesenteric vein process Figure 72.2 Transverse section of the pancreas. Note the position of the uncinate process behind the vessels.

ble ductular patterns. Between the 12th and 40th weeks of fetal life, the pancreas di ff erentiates into exocrine and endocrine elements. The primitive ducts and their ductules are respon sible for the lobular arrangement of the pancreas . Congenital anomalies of the pancreas are varied and arise during the early Summary box 72.1 Anomalies of the pancreas /uni25CF /uni25CF /uni25CF

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TABLE 72.1 Steps in the development of the pancreas. 1 Day 26 Dorsal pancreatic duct arises from the dorsal side of the duodenum 2 Day 32 Ventral bud arises from the base of the hepatic diverticulum 3 Day 37 Contact occurs between the two buds. Fusion by the end of week 6 4 Week 6 Ventral bud produces the

head and uncinate process 5 Week 6 Ducts fuse 6 Week 6 Ventral duct and distal portion of the dorsal duct form the main duct (duct of Wirsung) 7 Week 6 Proximal dorsal duct forms the duct of Santorini 8 Month 3 Acini appear 9 Months Islets of Langerhans appear and become 3–4 biologically active Aplasia Hypoplasia Hyperplasia Hypertrophy Dysplasia a Variations and anomalies of the ducts Pancreas divisum Rotational anomalies a Annular pancreas Pancreatic gallbladder a Polycystic disease Congenital pancreatic

cysts a Cystic /f_i brosis von Hippel–Lindau syndrome a Ectopic pancreatic tissue, accessory pancreas Vascular anomalies a Choledochal cysts Horseshoe pancreas a The more frequent anomalies encountered in surgical practice. ‘Normal’ pancreatic ducts 60% Suppression of the Suppression of the accessory duct main duct (Santorini) (Wirsung) Pancreas 30% 10% divisum Wirsung branch Wirsung branch Figure 72.3 Variations in the pancreatic ducts. (a) Normal. (b–d) Pro

gressive suppression of the accessory duct (30%). (e–g) Progressive suppression of the main duct (10%). (f, g) Pancreas divisum.

Figure 72.4 Variations in the relation of the common bile duct and main pancreatic duct at the main duodenal papilla. In (a) there is a common channel with no sphincter mechanism protecting /f_l ow between the ducts. In (b) there is a partial common channel, while in (c) there is separation of the two channels. Gallstone pancreatitis is more likely with (a) and (b) . 1 2 3 4 Figure 72.5 The complexity of the sphincter of Oddi. (1) Superior cho ledochal sphincter; (2) inferior choledochal sphincter; (3) ampullary sphincter; (4) pancreatic sphincter.

Revision #1
Created 2025-12-31 15:26:56 UTC by Omar Ayman
Updated 2025-12-31 15:26:56 UTC by Omar Ayman