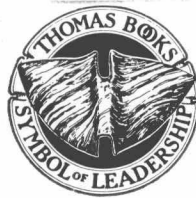


Roentgen Manifestations of Pancreatic Disease

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Preface

CONSIDERING its contents, the title of this book might just as well have been "Some Roentgen Manifestations of Diseases of the Upper Abdomen with Special Reference to the Pancreas." This is due to the fact that it is inherently impossible to present the roentgen pancreatic story without discussing the surrounding viscera. This conclusion depends upon the present inability to satisfactorily opacify the pancreas and thus visualize it directly without too much recourse to the appearance of the surrounding viscera. It is mandatory, in most instances, to infer the morbid anatomical features of the pancreas from the effects that primary pancreatic disease produces upon the opacified adjacent or distant viscera and other structures, or from the effects that primary disease of the opacified surrounding viscera produce secondarily upon the pancreas.

Therefore, while the direct roentgen interest has been primarily focused upon the pancreas, the obvious necessary spill-over of consideration into the adjacent and distant viscera has made it necessary to consider their abnormalities and the roentgen methods for their apprehension to the extent deemed necessary. This necessity was further heightened when the chapter on differential diagnosis was formulated.

Naturally, the diseases of the surrounding viscera cannot, therefore, be considered as having received an exhaustive presentation; but every effort has been made to make the roentgen presentation of the pancreas as complete as the present knowledge warrants. The main guiding thought has been the presentation of the roentgenologic survey of the anatomy, physiology, and pathology of the pancreas.

From the roentgen viewpoint, the pancreatic region has for a long time been one of the silent abdominal areas. As in the case of the small bowel, increasing attention has brought about a change.

Accuracy in roentgen diagnosis of pancreatic disease has steadily advanced from a position of doubt to one of true value, mainly as a result of careful scrutiny of: 1. the pancreatic area directly; and,

2. the opacified regional viscera which are so intimately related to the pancreas.

The advances in surgical fields whereby carcinoma of the head of the pancreas can be radically resected have made it practically mandatory for the roentgenologist to recognize these lesions earlier.

Of all the pioneers in this phase of roentgenology, the name of James T. Case is among the foremost. He has participated in and has been personally responsible for many of the earlier advances. He has constantly sought to devise various methods and maneuvers to arouse and confirm the suspicion of disease of the pancreas.

Of all the recent contributors, the name of E. B. D. Neuhauser is noteworthy for his advances in the roentgenological recognition of fibrocystic disease of the pancreas, meconium ileus and meconium peritonitis. Naturally, in the interval, many have made their contributions, and care has been exercised to award credit where known to be due.

The author has drawn heavily upon the basic simple established facts that form the strong and broad foundations upon which the present day practice of diagnostic roentgenology stands. Each of these now commonplace facts must of necessity have had a beginning in the mind of some investigator long since forgotten. For it is a notorious but nevertheless true fact, that one continually absorbs, uses, but frequently forgets the original source of ideas. The author extends his grateful acknowledgment, therefore, in a collective fashion to all those pioneers who have been responsible for the basic facts upon which the present state of high diagnostic roentgen achievement rests.

The author wishes to thank Dr. Charles S. Cameron, Medical and Scientific Director and Dr. S. Aubrey Schneider, Assistant Director, Statistical Research Section of the Medical Department, both of the American Cancer Society, for the tables and the chart depicting the deaths from cancer of the pancreas.

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New York City

M. H. P.

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General Considerations

THE PANCREAS is one of the few viscera in the abdomen which defies opacification by dye. Contrast studies after induced pneumoperitoneum or retropancreatic air insufflation are still not simple routine procedures.

The specific density of the pancreas is about the same as that of its surrounding tissues; therefore, it cannot be visualized directly on the roentgenogram, except under a few special circumstances which will be discussed later.

Dozzi and Bockus exposed the core of the problem when they stated that there is a great disparity between the importance of the functions of the pancreas and our ability to discern evidence of abnormalities therein, either functional or organic; and that this fact constitutes a real challenge. This disparity is amplified: (1) by the fact that many conditions are not evident until far advanced and even then simply manifest themselves as a dysfunction of the biliary or gastro-intestinal tracts; (2) by the fact that the organ is inaccessible to palpation; (3) by the infrequency of direct roentgen signs; and (4) by the fact that the pancreas has a large margin of safety in its physiological reserve, so that considerable disease may exist without any clinical, roentgen or other evidence.

Despite the hidden anatomic position of the pancreas, its relative direct inaccessibility and the absence of any direct opacification method, the roentgen examination still affords the best means for the diagnosis of its abnormalities.

It is necessary, however, in most instances to use indirect methods to develop the roentgen manifestations of disease of the pancreas. Fortunately, the pancreas is so situated that many of the surrounding viscera may be opacified and the effects of pancreatic disease upon these surrounding viscera studied.

The evaluation of these roentgen manifestations and their proper translation into terms of pathologic anatomy requires an understanding of its anatomy.

In reviewing the gross anatomy, it is important to distinguish between the fixed descriptive anatomy of cadavers and the dynamic, fluid or plastic anatomy of the living subject. Cadavers are, in the main, essentially adult or senile pathological material, shriveled, toneless caricatures of the living, wherein postmortem changes have supervened, altering the basic normal anatomic status. Radiologic anatomy belies the old conception of fixed form, size and position. Nature has no set forms and no standardized functions. She has a variety of forms at her command which she merges one into the other, balancing up the many factors she uses. Habitus, postural state, condition of the abdominal wall, respiratory phase, ingestion of food, and state of filling of the other regional organs affect the size, shape and position of the pancreas.

The Pancreas

Development and Anatomy

ALTHOUGH the pancreas in the adult is a single gland, it arises in the 3-4 mm. embryo as two entodermal outgrowths. These are known as the ventral and dorsal pancreatic anlages. Some authorities describe a paired ventral anlage, one of which atrophies very early. Others describe a ventral anlage consisting of a right and left half and state that the left half atrophies in the very early stages.

The dorsal anlage pushes out from the dorsal wall of the intestinal tube just above the level of the hepatic diverticulum. The ventral anlage pushes out in the caudal angle between the intestinal tube and the hepatic diverticulum. Of the two anlages, the dorsal one grows more rapidly. In the sixth week it is an elongated, nodular structure with a centrally coursing duct. It extends into the dorsal mesentery and, since it arises near the mouth of the developing omental bursa, continues its growth within the dorsal layer of that sac. The ventral pancreatic bud remains smaller. It is carried away from the duodenum by the lengthening common bile duct so that the ventral pancreatic bud now arises from the common bile duct and no longer from the intestinal tube. Unequal growth of the duodenal wall shifts the bile duct dorsad and brings the ventral pancreas into the dorsal mesentery near the stem of the dorsal pancreas. During the second week the two interlock intimately so that no histologic distinction exists between the derivatives of the two original components.

After the dorsal and ventral pancreases have come in contact, a certain degree of migration occurs. The dorsal pancreas is much larger than the ventral pancreas. It grows across the body towards the left until it reaches the hilum of the spleen. Thus it gives rise to the body and tail and a small anterior portion of the head. The larger posterior portion of the head is derived from the ventral pancreas.

The short ventral duct taps the long dorsal duct early so that thereafter the long distal segment of the dorsal duct and the entire