

Diagnosis of Annular Pancreas Using Minimum Intensity Projection of Multidetector Row CT: Case Report¹

Hyun Cheol Kim, M.D., Sung Il Park, M.D., Seong Jin Park, M.D.², Hyeong Cheol Shin, M.D., Hae Kyung Lee, M.D.², Young Tong Kim, M.D., Won Kyung Bae, M.D., Il Young Kim, M.D.

Annular pancreas is a rare congenital abnormality characterized by a ring of pancreatic tissue encircling the second portion of the duodenum, and it is definitively diagnosed by endoscopic retrograde cholangiopancreatography. We present here a case of annular pancreas that was diagnosed by the minimum intensity projection technique of multidetector row CT. On the CT scan, the annular pancreas was demonstrated as the pancreatic tissue with an aberrant pancreatic duct encircling the duodenum.

Index words : Computed tomography (CT), multi-detector row
Pancreas, abnormalities

Annular pancreas is a rare congenital malformation of the pancreas in which a section of pancreatic tissue completely or partially encircles the second portion of duodenum, and the anatomical anomaly frequently results in varying degrees of duodenal obstruction (1). About half of all patients with annular pancreas present with their initial symptoms in adulthood (2). Symptomatic cases should be surgically treated, but the diagnosis of annular pancreas is usually made by the endoscopic retrograde cholangiopancreatography (ERCP). However, ERCP is an invasive method and it can fail at times due to the inability to pass the endoscope to a point required for cannulation (3). Recently developed multidetector row computed tomography (MDCT) and the parallel improvements in the capabilities of the workstations allow for the high quality minimum intensity projection (MinIP) technique, and this provides detailed information on the pancreatic ductal anatomy (4).

We present here a case of annular pancreas and its aberrant pancreatic duct that was clearly shown on MDCT using the MinIP images.

Case Report

A previously healthy 67-year-old man who was suffering from mild epigastric discomfort was admitted to our hospital. The laboratory findings were within normal limit. Upper gastrointestinal endoscopy and radiologic imaging revealed mild annular narrowing of the second portion of the duodenum with the preserved mucosal folds (Fig. 1). For further evaluation of the luminal narrowing of the duodenum, an abdominal CT scan was performed with an eight-channel MDCT scanner (LightSpeed Ultra, General Electric, Milwaukee, WI, U.S.A.). After ingestion of 800 - 1000 mL of water for neutral oral contrast, the precontrast scan was performed to screen for pancreaticoliths or calcifications. Postcontrast scans of the pancreaticobiliary region were performed with a delay of 35 seconds for the arterial phase and a delay of 70 seconds for the portal venous phase after the infusion of 150 mL of nonionic contrast material (Iomeprol; Bracco, Milano, Italy) at a rate of 3 mL/sec. The technical parameters were a detector row

¹Department of Diagnostic Radiology, Soonchunhyang University, Cheonan Hospital

²Department of Diagnostic Radiology, College of Medicine, Soonchunhyang University, Bucheon Hospital

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Address reprint requests to : Hyun Cheol Kim, M.D., Department of Diagnostic Radiology, Soonchunhyang University, Cheonan Hospital 23-20 Bongmyungdong, Cheonan, Choongnam, 330-721, Korea
Tel. 82-41-570-3515 Fax. 82-41-579-9026 E-mail: khcppp@lycos.co.kr

configuration of 8×1.25 mm, collimation of 1.25 mm, slice thickness of 5 mm, table speed of 13.5 mm/rotation, pitch of 1.35 and a rotation time of 0.8 sec. The MinIP images were created at a satellite workstation (AW 4.1 on HP \times 4000, General Electric, Milwaukee, WI, U.S.A.), using variable slab thickness according to the planes oriented throughout the pancreatic duct. The arterial phase images showed that the pancreatic tissue was encircling the second portion of the duodenum (Fig. 2A). Coronal oblique MinIP image depicted an annular pancreatic duct communicating with the Wirsung's duct (Fig. 2B). The axial oblique MinIP image very well demonstrated the annular pancreatic duct completely encircling the second portion of the duodenum with its probable communication to the main pancreatic duct (Fig. 2C). The patient did not have any other symptoms other than his epigastric discomfort, and so he was discharged without treatment. The condition of the patient has been stable and uneventful during a one-year follow-up.

Discussion

Annular pancreas is an uncommon congenital anomaly in which a ring of normal pancreatic parenchyma encircles the second portion of the duodenum. Although several theories have been proposed to explain the formation of annular pancreas, the exact pathogenesis is still controversial. Three main theories exist as to the formation of the annular pancreas (5): the first theory suggests that hypertrophy of both the dorsal and ventral primordia results in a complete ring of pancreas around the duodenum; the second theory suggests the persistence and enlargement of the left bud of the paired ventral primordium; the third theory suggests the adherence of the right bud of the ventral primordium to the duodenum before rotation. Kamisawa *et al.* (6) have recently reported a new embryologic hypothesis for annular pancreas, that the tip of the left bud of the ventral primordium adheres to the duodenum and stretches to form a ring during development. They suggested that several arrangements of the annular duct could be created depending on whether the tip is proximal or distal to the common bile duct.

Although annular pancreas is a congenital anomaly, half of the patients may be asymptomatic until adulthood (2), and at times, asymptomatic annular pancreas has been reported incidentally (7). Treatment of the annular pancreas depends on the symptoms, and no thera-

py is warranted for those patients who are without symptoms (1).

The diagnosis of annular pancreas in adults has been usually based on the ERCP findings that include depiction of an annular pancreatic duct encircling the duodenum (8). However, ERCP is an invasive modality that is associated with significant risk of complications and it requires considerable operator skill. Magnetic resonance cholangiopancreatography (MRCP) allows for an accurate and noninvasive diagnosis of an annular pancreas (9).

The recently introduced MDCT and the development of 3D postprocessing imaging software have significantly improved the ability of CT to image the pancreatic duct and evaluate a wide range of pancreatic abnormalities (4). The MinIP provides high-quality projection images of the pancreatic duct against the background of the normally enhancing pancreatic parenchyma, and the images are similar in appearance to those obtained by ERCP or MRCP. Because MDCT with three-dimensional reconstruction has been reported to clearly show the pancreatic ducts, pancreatic anatomy and pathology can be well demonstrated on MDCT (4, 10). However, to the best of our knowledge, the MDCT image findings

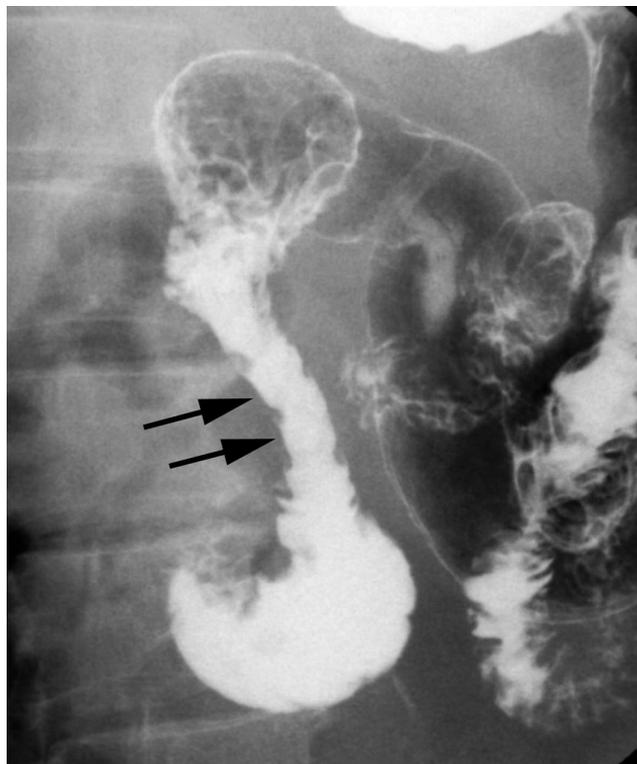


Fig. 1. Image of an upper gastrointestinal study shows the mild annular narrowing (arrows) of the second portion of the duodenum with normal mucosal patterns.

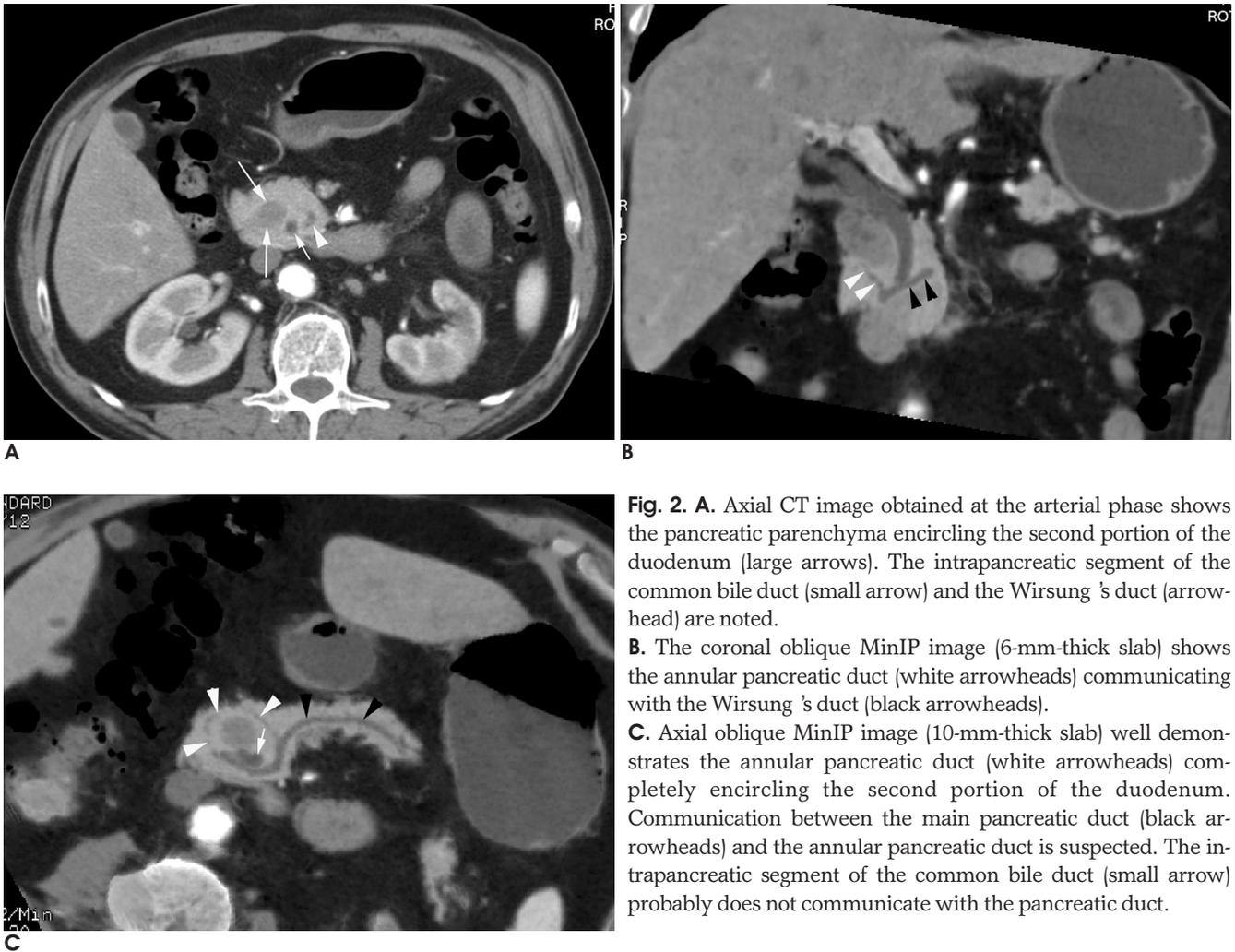


Fig. 2. **A.** Axial CT image obtained at the arterial phase shows the pancreatic parenchyma encircling the second portion of the duodenum (large arrows). The intrapancreatic segment of the common bile duct (small arrow) and the Wirsung's duct (arrowhead) are noted. **B.** The coronal oblique MinIP image (6-mm-thick slab) shows the annular pancreatic duct (white arrowheads) communicating with the Wirsung's duct (black arrowheads). **C.** Axial oblique MinIP image (10-mm-thick slab) well demonstrates the annular pancreatic duct (white arrowheads) completely encircling the second portion of the duodenum. Communication between the main pancreatic duct (black arrowheads) and the annular pancreatic duct is suspected. The intrapancreatic segment of the common bile duct (small arrow) probably does not communicate with the pancreatic duct.

using the MinIP technique for an annular pancreas have not been previously described.

In our case, the MinIP images well demonstrated the annular pancreatic duct and its relationship with the main pancreatic duct, and this can provide a quick anatomic overview to the clinician. Since this patient was relatively asymptomatic, ERCP to establish the diagnosis of an annular pancreas was not clinically considered. Although the proper evaluation of the ductal opening between the annular pancreatic duct and the main pancreatic duct should be performed by ERCP, the ductal opening could be presumed to exist on the MinIP images, as in our case of annular pancreas.

In conclusion, the findings in our patient suggest the potential value of MinIP images of MDCT for evaluating the annular duct of an annular pancreas. Although further investigation is required to establish the usefulness of MinIP technique for the assessment of patients with annular pancreas, we believe that this modality may be another useful imaging technique for noninvasively

evaluating the annular pancreatic duct.

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