OPEN

Agenesis of the Dorsal Pancreas: Case Report and Review of Age-Related Differences in Presentation

*Callie A. Grey, MD, †Ajinkya Desai, MD, ‡Michael J. Nowicki, MD, and ‡Natalie Bhesania, MD

Abstract: Agenesis of the dorsal pancreas (ADP) is a rare congenital anomaly that occurs when the body and tail of the pancreas fail to develop from the dorsal bud in utero. ADP may be discovered when evaluating conditions arising from the anomaly, such as diabetes mellitus, pancreatitis, and pancreatic insufficiency, but is more commonly found as an incidental finding. To date, fewer than 120 cases have been reported in the literature. We report a 6-year-old male who was found to have ADP on computed tomography during the investigation of abdominal pain and vomiting. We review the variable presentation, genetic mutations, and age-related differences between children and adults with this rare condition.

INTRODUCTION

Agenesis of the dorsal pancreas (ADP) occurs when the body and tail of the pancreas fail to develop from the dorsal bud in utero (1). ADP is a rare congenital anomaly with the majority of reports involving adult patients. We report a 6-year-old male who presented with abdominal pain and vomiting and was incidentally found to have ADP on imaging.

CASE PRESENTATION

A 6-year-old Caucasian male presented to his pediatrician with a 4-day history of abdominal pain and vomiting, which was nonbloody and nonbilious. He was diagnosed with viral gastroenteritis and managed supportively. Symptoms persisted, prompting evaluation in the emergency department. He had no history of diabetes mellitus (DM), poor growth, recurrent abdominal pain, pancreatitis, or diarrhea. Physical examination was significant for being overweight (weight 26.8 kg, 92nd percentile; body mass index = 18.6 kg/M^2, 95th percentile). Laboratory evaluation, including complete blood count, amylase, lipase, comprehensive metabolic panel, and urinalysis, was unremarkable, except for mild elevation of liver enzymes (alanine transaminase: 46 [10–35 U/L] and aspartate transaminase: 43 [10–30 U/L]). A computed axial tomography (CT) scan showed a dilated small bowel with concern for an ileus, hepatic steatosis, and inability to visualize the pancreatic tail (**Fig. 1**). His presentation was thought to be the result of viral gastroenteritis. He received supportive care and was referred to pediatric gastroenterology for evaluation of the elevated transaminase levels and CT scan findings. The patient was asymptomatic at the time of follow-up with persistent, mild transaminase elevation (aspartate transaminase = 64 U/L {10–30 U/L}; alanine transaminase = 53 U/L{10–35 U/L}). Evaluation for an etiology of transaminase levels was negative, including infectious serology (hepatitis A virus, hepatitis B virus, and hepatitis C virus), autoimmune serology (antinuclear antibody, antismooth muscle antibody, liver-kidney-microsomal antibody, and liver soluble antigen), ceruloplasmin, alpha-1-antitrypsin mutational analysis, lysosomal acid lipase activity, and tissue transglutaminase level. Magnetic resonance cholangiopancreatography was performed, which confirmed agenesis of the pancreatic body and tail. The pancreatic duct was only visualized in the head of the pancreas

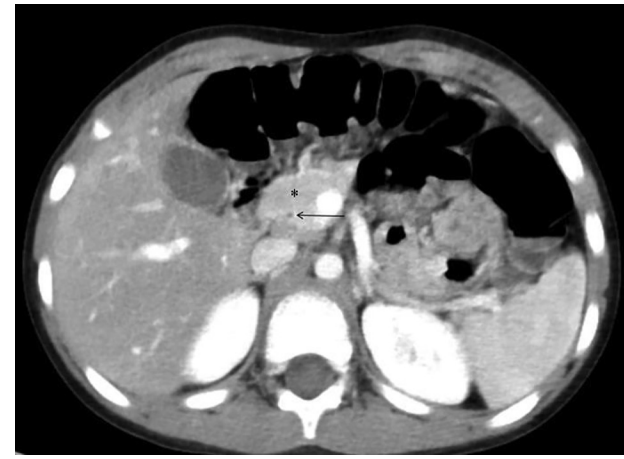

FIGURE 1. Axial contrast-enhanced computerized tomography (CT) scan of the abdomen demonstrates the pancreatic head (asterisk) and main pancreatic duct (arrow), with an absent body and tail.

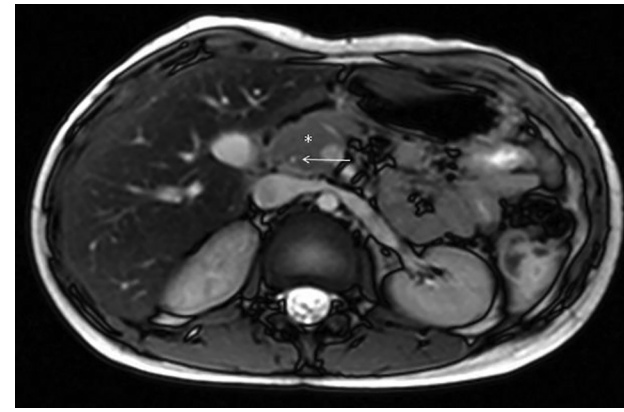

FIGURE 2. Axial T2 weighted magnetic resonance imaging (MRI) of the abdomen demonstrates similar findings as the computerized tomography (CT) scan; the pancreatic head (asterisk) with the main pancreatic duct (arrow), with no body or tail.

Received April 29, 2022; accepted May 20, 2023.

From the *Division of Interventional Radiology, Department of Pediatrics, University of Mississippi Medical Center, Jackson, MS; †Division of Pediatric Gastroenterology, Division of Interventional Radiology, University of Mississippi Medical Center, Jackson, MS; and ‡Division of Pediatric Gastroenterology, University of Mississippi Medical Center, Jackson, MS

Correspondence: Natalie Bhesania, MD, Division of Pediatric Gastroenterology, University of Mississippi Medical Center, 2500 North State Street, Jackson, MS 39216. E-mail: nbhesania@umc.edu

The authors report no conflicts of interest.

Copyright © 2023 The Author(s). Published by Wolters Kluwer Health, Inc. on behalf of the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition and the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

JPGN Reports (2023) 4:3(e337)
ISSN: 2691-171X
DOI: 10.1097/PG9.0000000000000337

and measured approximately 2 mm in diameter (Fig. 2). Fecal pancreatic elastase (>500 mcg/g) and hemoglobin A1c (5.1%) were normal. At his 1-year follow-up, he remained asymptomatic, and transaminase levels had normalized.

DISCUSSION

ADP is a rare condition, with the majority of cases being described in adults and only 22 cases in the pediatric literature (2–11). Pediatric and adult patients differ in their clinical presentation. In the pediatric population, the mean age of discovery of ADP is reported to be 8 years of age, compared with the adult population where the mean age of discovery is 45.6 years of age (2–11). While there is a male predominance (68%) of ADP among the pediatric population, it is seen more frequently among females (56%) in the adult population (2–11).

ADP is often discovered on imaging during the investigation of abdominal pain. The source of associated pain is hypothesized to be caused by sphincter of Oddi dysfunction, duodenal obstruction, pancreatitis, or perhaps unrelated, thought to be the case for our patient, though often the etiology of the pain remains undetermined (7). In the pediatric population, 14% of children with ADP have associated abdominal pain (2–11). Given that abdominal pain is a common complaint among pediatric patients and imaging is not obtained in every case, it is possible that more cases of ADP exist and are thus not identified.

Disorders of glucose metabolism are associated with ADP, given that the majority of islet cells are located in the body and tail of the pancreas (12). Among reported children with ADP, 50% were found to have diabetes before the discovery of ADP (2–11). Schnedl et al (1) suggested that 50% of adults with ADP have associated hyperglycemia and DM. These findings suggest that the onset of diabetes in patients with ADP occurs in childhood. Exocrine pancreatic insufficiency, resulting from decreased pancreatic volume, was also reported among the pediatric population with ADP (36%) (2–11). The literature shows a much smaller number of adults with ADP manifesting pancreatic insufficiency (6%) (5,13). Thus far, our patient has shown no evidence of diabetes or pancreatic insufficiency. He is being followed biannually, and the family was counseled regarding potential complications. We have planned to screen our patient annually for DM with a hemoglobin A1c and a confirmatory fasting or 2-hour postprandial glucose level should the A1c suggest a diagnosis of diabetes (>6.5%). It is worth noting that our patient may be at risk for not only type 1 but also type 2 DM given his body mass index (95th percentile). We have also opted to screen annually for exocrine pancreatic insufficiency with fecal elastase-1, given that exocrine pancreatic insufficiency can present subtly with mild abdominal pain or bloating.

ADP was considered a serendipitous finding if it was discovered during the investigation of symptoms not related to ADP or, in the case of diabetes, ADP was found investigating symptoms other than new-onset diabetes. ADP was an incidental finding in 4 (18%) of the reported children during the investigation of unrelated complaints or at autopsy (2–11). Wildling et al (14) described ADP in 2 asymptomatic male children whose mother was diagnosed with insulin-dependent diabetes and subsequently found to have complete ADP during the investigation of symptoms. This suggests a familial or genetic link to this condition. To date, 7 families are reported with more than 1 member exhibiting ADP (2,3,5,10,14,15).

The focus for causative gene defects has concentrated on genes that play a role in the embryologic development of the pancreas. Haldorsen et al (5) described 2 Norwegian families with maturity-onset diabetes of the young and known haploinsufficiency in the human nuclear factor 1β (HNF1 β) gene with the assessment of pancreatic exocrine function and imaging studies. All 5 patients were found to have pancreatic insufficiency and the absence of the dorsal pancreas by CT and magnetic resonance imaging (5). Caetano et al (2) described a father and son with maturity-onset diabetes of the young and ADP with haploinsufficiency in the PDX1 gene (c.188delC) (2). Yorifuji et al (10) described a mother and 2 children with diabetes and ADP who were screened for defects in a number of genes associated with pancreatic development, including GATA6, PDX1, PTF1A, HNF1β, HNF1A, HNF4A, GCK, NGN3, and MNX1. All 3 were found to have a haploinsufficiency in GATA6 (c.1504_1505delAA). Gene mutations that have been linked to ADP include PDX1 (13q12), PTF1A (10p12.3), HNF1β (17q12), RFX6 (6q22.1), EIF2AK3 (2p11.1), and GATA6 (18q11.2) (2,5). No genetic testing has been performed to date on our patient or any family members.

A number of malformations have been reported in association with ADP, including renal (pancake kidney, malrotated kidney, and absent kidney), cardiovascular (atrial septal defect, ventricular septal defect, pulmonic stenosis, coarctation of the aorta, transposition of the great arteries, tetralogy of Fallot, and preduodenal portal vein), genitourinary (bicornuate uterus and vagina agenesis), gastrointestinal (choledochal cyst), and heterotaxia (polysplenia, situs inversus, malrotation, and dextrocardia) (2,6,10).

ADP remains a rarely reported condition, often found incidentally. A number of other congenital anomalies have been described with ADP, but a true association has not been established. Familial occurrence has been described as related to defects in the PDX1 and GATA6 genes. Though no guidelines currently exist regarding the screening of patients with known ADP, healthcare providers should be aware of the variable presentations and associations with this finding. It is prudent to understand that conditions, such as diabetes, pancreatitis, various cancers, and other anomalies have been associated with ADP to provide optimal management of patients with ADP. Our report aims to highlight the variability of presentation and associated complications.

ACKNOWLEDGEMENT

The parents provided informed consent for the publication of the case details.

REFERENCES

1. Schnedl W, Piswanger-Soelkner C, Wallner S, et al. Agenesis of the dorsal pancreas. *World J Gastroenterol*. 2009;15:376–377.
2. Caetano L, Santana L, Costa-Riquetto A, et al. PDX1 -MODY and dorsal pancreatic agenesis: new phenotype of a rare disease. *Clin Genet*. 2018;93:382–386.
3. Chen R, Hussain K, Al-Ali M, et al. Neonatal and late-onset diabetes mellitus caused by failure of pancreatic development: report of 4 more cases and a review of the literature. *Pediatrics*. 2008;121:e1541–e1547.
4. Doxey BW, Jackson WD, Adler DG. A unique presentation: dorsal agenesis of the pancreas manifesting as pancreatic exocrine insufficiency in the absence of diabetes mellitus in an 8-year-old boy. *Dig Dis Sci*. 2008;53:2005–2006.
5. Haldorsen I, Vesterhus M, Raeder H, et al. Lack of pancreatic body and tail in HNF1B mutation carriers. *Diabet Med*. 2008;25:782–787.
6. Herman T, Siegel M. Polysplenia syndrome with congenital short pancreas. *AJR Am J Roentgenol*. 1991;156:799–800.
7. Joo Y, Kang H, Kim H, et al. Agenesis of the dorsal pancreas: a case report and review of the literature. *Korean J Intern Med*. 2006;21:236–239.
8. Karcaaltincaba M. CT differentiation of distal pancreas fat replacement and distal pancreas agenesis. *Surg Radiol Anat*. 2006;28:637–641.
9. Vijayaraghavan S, Gouru S, Senthil S. Sonographic features of agenesis of dorsal pancreas. *Indian J Radiol Imaging*. 2013;23:179–182.

10. Yorifuji T, Kawakita R, Hosokawa Y, et al. Dominantly inherited diabetes mellitus caused by GATA6 haploinsufficiency: variable intrafamilial presentation. *J Med Genet*. 2012;49:642–643.
11. Jung J, Hur J, Jung M, et al. Diabetes mellitus due to agenesis of the dorsal pancreas in a patient with heterotaxy syndrome. *Ann Pediatr Endocrinol Metab*. 2017;2:125–128.
12. Dey S, Singh M, Kaura A, et al. A rare case of complete agenesis of dorsal pancreas. *Euroasian J Hepatogastroenterol*. 2017;2:183–184.
13. Sakpal S, Sexcius L, Babel N, et al. Agenesis of the dorsal pancreas and its association with pancreatic tumors. *Pancreas*. 2009;38:367–373.
14. Wildling R, Schnedl W, Reisinger E, et al. Agenesis of the dorsal pancreas in a woman with diabetes mellitus and in both of her sons. *Gastroenterology*. 1993;104:1182–1186.
15. Winter W, Maclaren N, Riley W, et al. Congenital pancreatic hypoplasia: a syndrome of exocrine and endocrine pancreatic insufficiency. *J Pediatr*. 1986;109:465–468.