Case Report

Pancreatic Neuroendocrine Tumor in the Setting of Dorsal Agenesis of the Pancreas

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Dorsal agenesis of the pancreas (DAP) is an uncommon embryological abnormality where there is absence of the distal pancreas. DAP is mostly asymptomatic, but common presenting symptoms include diabetes mellitus, abdominal pain, pancreatitis, enlarged pancreatic head, and, in a few cases, polysplenia. MRCP and ERCP are the gold standard imaging techniques to demonstrate the absence of the dorsal pancreatic duct. The literature on the association of pancreatic neoplasia and DAP is limited. We present the case of a pancreatic neuroendocrine tumor in a patient with dorsal agenesis of the pancreas, with a review of the related literature.

1. Introduction

Dorsal agenesis of the pancreas (DAP) is an uncommon embryological abnormality where there is absence of the distal pancreas. Here, we present the case of a 48-year-old female who was referred to our surgical oncology clinic for a pancreatic mass and was found to have concurrent DAP. We then discuss the embryology of DAP, as well as the most common clinical presentations of DAP and other established reports of DAP in the literature.

2. Case Report

A 48-year-old female was referred to the surgical oncology clinic for evaluation of a pancreatic mass. This was found incidentally on workup for an endometrial stromal sarcoma, for which she had undergone a total abdominal hysterec-tomy with bilateral salpingo-oophorectomy. The patient was asymptomatic.

Her past medical history was significant for uterine sarcoma and for venous thromboembolism which led to a pulmonary embolus but was otherwise unremarkable. Her physical exam was unrevealing, as was her serum laboratory evaluation, with normoglycemia, normal hepatobiliary function, normal pancreatic enzymes, and no elevation in carbohydrate antigen 19-9, carbohydrate antigen 125, or carcinoembryonic antigen. CT and MRI imaging (Figure 1) revealed a mass at the neck of the pancreas, measuring 2.9 cm in its largest dimension, as well as the absence of the distal body and tail of the pancreas. The mass closely abutted the confluence of the portal vein and superior mesenteric vein, but there was no invasion. She underwent biopsy of this mass via endoscopic ultrasound which revealed features consistent with a well differentiated neuroendocrine tumor. The tumor was determined to be nonfunctioning given the absence of systemic symptoms and laboratory data to suggest hormone production.

The patient underwent resection of this mass via spleen preserving laparoscopic approach. Intraoperative images confirmed the absence of the distal body and tail of the pancreas (Figure 2). Negative margins were achieved with this resection, and the pancreatic head and uncinate process were preserved, as were the splenic vein and artery. The pancreatic parenchyma was transected using a linear cutting stapler, with a closed staple height of 1.5 mm, and the remnant pancreatic neck was buttressed with an omental patch. A 19 Fr fluted Blake drain was placed at the resection margin at
the time of surgery. Final pathology revealed a grade 1 well differentiated pancreatic neuroendocrine tumor (Figure 3).

Despite our intraoperative efforts to avoid it, the patient's postoperative course was significant for a pancreatic duct leak, which was well controlled by her drain, and she was discharged home on POD 4. Her drain was removed on POD 23. She had no evidence of diabetes or pancreatic insufficiency on follow-up evaluation. Her case was discussed at our multidisciplinary tumor board and no further treatment for this tumor was recommended.

3. Discussion

3.1. Embryology of the Pancreas. During the fourth week of gestation, the dorsal (cranial) and ventral (caudal) buds of the pancreas develop from the endoderm at the junction of the foregut and the midgut. While the dorsal bud develops only into pancreatic tissue (anterior head, body, and tail), the ventral bud also contributed to the liver, gallbladder, bile ducts, and ventral pancreas (posterior neck and head) [1]. The ventral pancreatic duct (duct of Wirsung) and the common bile duct thus share a common entry point to the duodenum at the major papilla. Eventually, the ventral bud rotates clockwise and fuses with the dorsal bud at the seventh week of gestation. At this time, the dorsal pancreatic duct (duct of Santorini) fuses with the ventral pancreatic duct to create the main pancreatic duct [2]. Islets of Langerhans primarily develop in the dorsal pancreas, at week twelve of gestation.

3.2. Dorsal Agenesis. Dorsal agenesis occurs when there is abnormal development of the dorsal pancreatic bud, but there is intact development of the ventral pancreatic bud. Thus, there is absence of the anterior head, body, and the tail of the pancreas with intact formation of the liver, gallbladder, bile ducts, and posterior neck and head of the pancreas. The dorsal pancreatic duct never forms, and pancreatic secretions course from the ventral pancreatic duct into the common bile duct and eventually pass through the major papilla into the second portion of the duodenum.

The first case of dorsal agenesis of the pancreas (DAP) was reported in 1911 as an autopsy finding, and since then there have been relatively few reported cases in the literature [1]. DAP can be complete or partial. In patients with complete DAP, the dorsal duct system and the body and the tail of the pancreas are all missing. However, in partial DAP, the accessory papilla, the terminal end of the main dorsal duct of Santorini, or the pancreatic body is present. Familial DAP has been described in association with other congenital deformities, as well as alone. The molecular basis for DAP is not well defined; however, certain homeobox genes have been associated with DAP in rodent models [10].

DAP can be asymptomatic due to exocrine and endocrine functional reserve in the remaining pancreas. However, given that most of the islets of Langerhans develop in the body and tail of the pancreas, diabetes mellitus can occur [1]. Other common findings in association with DAP include abdominal pain, pancreatitis, enlarged pancreatic head, and, in a few cases, polysplenia [3, 11]. Diagnosis of DAP requires demonstration of the absence of dorsal pancreatic tissue. CT can be useful as an initial study to delineate the size of the pancreas. MRCP and ERCP are the gold standard imaging techniques to demonstrate the absence of the dorsal
| Reference          | Presenting symptoms                          | Imaging modality to confirm DAP | Operation                  | Final tumor histology               |
|-------------------|----------------------------------------------|---------------------------------|-----------------------------|------------------------------------|
| Matsusue et al. 1984 [3] | Abdominal pain, weight loss, hyperglycemia | ERCP                            | Total pancreatectomy        | Ductal adenocarcinoma              |
| Nakamura et al. 2001 [4] | None                                         | ERCP                            | Subtotal pancreatectomy     | Solid pseudopapillary tumor        |
| Ulusan et al. 2005 [5] | Abdominal pain, type II diabetes mellitus    | CT abdomen and pelvis           | Pancreatecoduodenectomy     | Solid pseudopapillary tumor        |
| Ulusan et al. 2006 [6] | Abdominal pain, jaundice, hyperglycemia      | Unknown                         | Hepaticojejunostomy         | Ductal adenocarcinoma              |
| Rittenhouse et al. 2001 [2] | Abdominal pain, type II diabetes mellitus    | ERCP                            | Pancreatecoduodenectomy     | Ductal adenocarcinoma              |
| Rittenhouse et al. 2001 [2] | Abdominal pain, weight loss, type II diabetes mellitus | CT abdomen and pelvis | Pancreatecoduodenectomy     | Ductal adenocarcinoma              |
| Rittenhouse et al. 2001 [2] | Elevated liver function tests, asymptomatic  | ERCP                            | Pancreatecoduodenectomy     | Ductal adenocarcinoma              |
| Kapoor and Singh 2011 [7] | Painless jaundice, weight loss, cholangitis  | Intraoperative pancreatogram    | Pancreatecoduodenectomy     | Ampullary carcinoma                |
| Sannappa et al. 2014 [8] | Jaundice, weight loss                        | MRI abdomen                     | Total pancreatectomy        | Periampullary adenocarcinoma       |
| Mistry et al. 2015 [9] | Painless jaundice, type II diabetes mellitus | CT abdomen and pelvis           | Pancreatecoduodenectomy     | Ampullary carcinoma                |
pancreatic duct [12]. Treatment of patients with DAP is
guided by the symptomatology with which they presented [1].

3.3. Pancreatic Neoplasia and Dorsal Agenesis. The association
of pancreatic neoplasia and DAP has not been studied extensively; a PubMed search identified 10 such cases
published since 2000 (Table 1) [2–9]. The mechanism of this
association is uncertain however. Some theorize that DAP
increases the risk of chronic pancreatitis, which in and of itself
is a risk factor for pancreatic tumors.

Treatment of pancreatic neoplasia in the setting of DAP
does not deviate from current management guidelines [13].
Surgical resection of pancreatic tumors in patients with DAP
often requires resection of the remaining pancreatic tissue,
with a high rate of insulin dependent diabetes mellitus and
exocrine insufficiency. In our case, we were able to preserve
the majority of the proximal pancreas, mitigating the risks of
postoperative diabetes.

4. Conclusion

We present the case of a pancreatic neuroendocrine tumor in
a patient with dorsal agenesis of the pancreas, which, to our
knowledge, has not previously been reported in the literature.
The patient presented with an asymptomatic, incidentally
discovered pancreatic mass at the neck of the pancreas that
was resected with negative margins via spleen preserving,
laparoscopic approach. This is one of the few cases of pancre-
atic neoplasia identified in patients with dorsal agenesis of the
pancreas (DAP), a rare developmental anomaly where there
is absence of the distal pancreas. DAP is most commonly
asymptomatic but can present with symptoms of new-onset
diabetes mellitus, abdominal pain, or chronic pancreatitis.
Because of its silent presentation, there are very few cases of
DAP reported in the literature and even fewer cases of DAP
with concurrent pancreatic neoplasia.

Competing Interests

The authors declare that there are no competing interests
regarding the publication of this paper.

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