Groove pancreatitis: A Case Report and Review of the Literature

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ABSTRACT

Groove pancreatitis is a rare form of segmental chronic pancreatitis. It involves the anatomic space between the head of the pancreas, the duodenum and the common bile duct. It was first described in the early 1970s, but it remains largely unfamiliar to most physicians. Radiological diagnosis can be challenging, as it is often difficult to differentiate it from other entities. The differential diagnosis from pancreatic head carcinoma may be difficult and recognition of subtle differences between these two entities is extremely important as the management differs significantly. Groove pancreatitis can be managed by conservative medical treatment, and surgery is reserved only for patients with persistent and severe clinical symptoms. We present a case of a 27 year-old male with groove pancreatitis and discuss the Magnetic Resonance Imaging (MRI) appearance of this entity as well as the differential diagnosis.

CASE REPORT

CASE REPORT

A 27 year-old male with history of moderate alcohol intake (30-40 gr/day) presented with recurrent epigastric pain irradiating to the back. Pancreatic enzymes, tumor markers (CA 19-9 and CEA) and liver tests were unremarkable. An abdominal MRI was performed including the following sequences: half-Fourier single-shot turbo spin-echo T2-weighted sequence in the transverse and coronal planes, with and without fat suppression; precontrast in-phase and out-of-phase 2D breath-hold dual echo gradient recalled echo (GRE); and postcontrast 3D-GRE T1-weighted sequences in the transverse plane. Postcontrast imaging was performed with power-injected (Medrad, Pittsburgh, PA, USA) bolus of 0.1 mmol/kg gadolinium chelate (MultiHance , Bracco Diagnostics, Milan, Italy) at 2 ml/s followed by a bolus 20 ml of saline flush. An enlarged pancreatic head with scattered hypointense areas on T1-weighted fat-suppressed images, associated to a sheet-like mass between the head of the pancreas and the duodenum, with duodenal wall thickening were found. This lesion was hypointense on T1- and on T2-weighted images, with patchy enhancement in the portal venous postgadolinium phase, and greater delayed enhancement, suggesting the fibrotic nature of the mass. Cystic changes in the pancreatoduodenal groove were also noted. Body and tail of the pancreas were unremarkable, with no

signs of chronic pancreatitis. Pancreatic and common bile ducts were minimally dilated, with distal smooth tapering. The peripancreatic vessels did not show signs of obstruction or encasement (figure 1).

Endoscopic ultrasound showed a hypoechoic mass with tiny calcifications and poorly defined margins, located between the pancreatic head and the duodenum accompanied by mild dilatation of the common bile duct with long and smooth tapering (figure 2). Multiple biopsies were obtained from the pancreatic head, major papilla and the pancreatoduodenal groove. Biopsy specimens demonstrated fibrous tissue proliferation and inflammation in the pancreatoduodenal groove with thickening and fibrosis of duodenal wall, Brunner glands hyperplasia and clustering of microcysts inside the layers of duodenal wall and the groove (figure 3). No malignancy was found.

The diagnosis of groove pancreatitis was made based on a combination of imaging and pathological findings and clinical/imaging follow-up. A second MRI was performed ten months later and the imaging findings were similar, excluding malignancy. The patient didn't undergo surgery given the certainty of the diagnosis and clinical improvement.

DISCUSSION

In our case, imaging findings that supported the diagnosis of groove pancreatitis were the typical location, the presence of associated cystic changes, the postgadolinium patchy and predominantly late enhancement and the absence of obstruction or encasement of the peripancreatic vessels [1, 2]. Although there was dilatation of the pancreatic and common bile ducts, this was minimal and with smooth tapering of the distal third, suggesting a benign nature [3, 4]. Stable focal masses with this location and characteristics are consistent with groove pancreatitis (segmental form).

Stolte et al introduced the term "groove pancreatitis" in 1982 [5], however Becker, who described a distinct form of focal chronic pancreatitis located in the pancreatoduodenal groove, first reported it in 1973 [6]. This is a potential anatomic space between the dorso-cranial part of the pancreatic head, the duodenum, and the common bile duct [7, 8]. Becker described two forms of groove pancreatitis, the "segmental" and the "pure". The former involves the pancreatic head with development of scar tissue within the groove, while the latter affects only the groove itself, sparing the pancreatic head [6]. Therefore, it may be difficult to recognize that this disease represents a form of chronic pancreatitis [8].

Groove pancreatitis remains largely unfamiliar to most physicians. Because of its relative obscurity and lack of large case series, the incidence of GP is not well known [3]. The disease was described in 2,7%, 19,5% and 24,5% of the cases, respectively, in three surgical series of pancreatoduodenectomy from patients with chronic pancreatitis [5, 9]. The pathogenesis is not yet elucidated [3-5, 9]. Peptic ulcer disease [4, 10], Santorini duct obstruction [11, 12], abnormal minor papilla [11], pancreatic heterotopia [11, 13], gastric resection [10] and true duodenal wall cysts [3, 4, 8, 14] have been suggested as possible etiologic factors. Alcohol abuse seems to be a precipitating factor [3, 11]. Patients diagnosed with groove pancreatitis are frequently alcoholic young men [5, 13].

In several studies no difference was found in age and gender distribution between this disease and common chronic pancreatitis [5, 6, 15]. Most patients are 30 to 50 year old men, typically with history of heavy alcohol intake [3]. Similarly to usual pancreatitis, most patients present with severe abdominal pain and recurrent vomiting [11, 14]. Recurrent vomiting is attributable to duodenal stenosis and can be more severe than in the usual form of pancreatitis [3, 10, 11, 16]. Jaundice and weight loss may also occur. Blood tests often reveal elevated pancreatic enzymes and tumor markers are usually normal [10, 11, 16].

Histopathologicaly the predominant feature is the presence of scar tissue and fibrosis in the pancreatoduodenal groove (pure form) and in the pancreatic head (segmental form) [3, 4]. The duodenum is always involved, revealing a chronic inflammatory process that leads to fibrosis and stenosis. Hyperplasia of Brunner's glands is almost always present [3]. Cystic changes in duodenal wall are often observed and many authors believe that these may represent cystic dystrophy of a heteropic pancreas in the duodenal wall [3, 17].

Groove pancreatitis may be treated by conservative medical measures, while surgery is reserved for cases of untreatable pain or to rule out malignancy when imaging alone or in conjunction with pathological analyses cannot perform the diagnosis [16]. Conservative measures including analgesics, pancreatic rest, and abstinence from alcohol are usually successful at treating initial symptoms, but may not be long lasting [14].

Groove pancreatitis appearance has been already described in different imaging studies [1, 3, 4, 14], with superior performance of MRI [4]. The most characteristic finding on MRI is a sheet-like mass between the head of the pancreas and the duodenum [3, 4, 16]. The mass is hypointense to pancreatic parenchyma on T1-weighted images [4], and according to the time of disease onset can be hypo-, iso- or slightly hyperintense on T2-weighted images [3]. This variation in the T2 signal has been related with the duration of the disease, since subacute disease exhibits brighter T2 images because of edema, and chronic disease has lower signal because of fibrosis [16]. Postgadolinium images show patchy enhancement more evident on venous phase, and progressive enhancement may be demonstrated on delayed imaging [13]. Delayed enhancement may also be seen in the thickened duodenal wall. These imaging features reflect the fibrous nature of GP lesions [16]. Cystic lesions in the groove or duodenal wall may be observed, particularly on T2-weighted images, [1, 4]. Duodenal wall thickening and duodenal wall stenosis are also frequent [4]. In the segmental form of the disease, some patients present with enlargement of the pancreatic head and may show mild, regular and progressive narrowing of the pancreatic duct [3]. Bile duct stricture is reported to be present in 50% of patients with this disease [3, 18]. This suggests that groove pancreatitis is not always accompanied by bile duct stricture [18, 19].

The differential diagnosis of GP includes pancreatic adenocarcinoma, periampullary cancers, pancreatic groove neuroendocrine tumor, cystic dystrophy of the duodenum and

acute pancreatitis with phlegmon along the groove. Differentiation of groove pancreatitis from pancreatic adenocarcinoma is particularly difficult in cases of scirrhous adenocarcimona of pancreas, because these two conditions may show similar findings [4, 11]. An important feature is the absence of major vessel encasement in groove pancreatitis, although some displacement may be observed. Graziani et al [2] reported that the gastroduodenal artery is displaced leftward in groove pancreatitis while, in carcinoma, is located between the lesion and the duodenum [2, 16]. Pancreatic adenocarcinoma extending to the peripancreatic tissue or the duodenum is expected to invade and obstruct peripancreatic vessels [4, 8, 13]. Ishigami et al [1] reported that patchy focal enhancement in the portal venous phase is most suggestive of groove pancreatitis, occurring in 14/15 (93%) patients. Patchy focal enhancement reflects pancreatic tissue in the inflammatory mass. In the same report peripheral enhancement was only seen in groove pancreatic carcinomas. Cystic lesions in the groove are more common in groove pancreatitis than in pancreatic carcinoma [13, 17]. Duodenal evaluation may also aid in differentiating groove pancreatitis from pancreatic cancer, as stenosis is less common with tumors in the pancreatic head [10]. T2-weighted and magnetic resonance cholangiopancreatography (MRCP) images often reveal a smooth stricture of the distal intra-pancreatic portion of the bile duct, as opposed to an irregular and abrupt stricture in pancreatic adenocarcinoma [3, 4]. Younger age is also more suggestive of GP [1].

Periampullary carcinomas include carcinomas arising from the ampulla of Vater, periampullary duodenum or distal common bile duct. Their presentation is similar to that of pancreatic head ductal adenocarcinoma [19, 20]. These tumors are typically a malignancy of older patients usually accompanied with jaundice and weight loss. Although these tumors are commonly sclerosing adenocarcinomas with high fibrous tissue content with low signal intensity on T1-weighted and T2-weighted images, they usually cause common bile duct stricture or abrupt termination at tumor level, typically showing a shoulder sign [21] instead of a longer and smooth tapering usually observed with groove pancreatitis [8]. Rarely, neuroendocrine tumors may occur within the groove. The pancreatoduodenal groove is an important space within the gastrinoma triangle whose vertices are the cystic duct confluence, the junction of the pancreatic neck and body, and the junction of the second and third portions of the duodenum. Gastrinoma is the most common neuroendocrine tumor occurring at the groove [7]. These tumors can be differentiated from GP by virtue of their hypervascularity on postcontrast images, with peripheral ring like enhancement on immediate postgadolinium GRE, their hyperintensity on fat suppressed T2-weighted images and hypervascular liver metastases [3, 22]. Cystic dystrophy of the duodenal wall is characterized by the presence of cysts within the duodenal wall that originate from ectopic pancreatic tissue, and the imaging findings are very similar to those of groove pancreatitis. It is unclear whether groove pancreatitis and cystic dystrophy of the duodenum are distinct entities or part of the same spectrum. Hence, a broad category labeled "paraduodenal pancreatitis" has been proposed to include groove pancreatitis, cystic dystrophy of the duodenal wall, and paraduodenal wall cysts [4]. The signal characteristics of the sheet-like mass are useful for differentiation from acute pancreatitis, since the phlegmon shows very high signal intensity on T2-weighted images [4, 7, 23]. Acute pancreatitis is generally associated with peripancreatic stranding and fluid; with changes evolving rapidly on serial imaging [4, 7, 23]. The pattern of enhancement also enables the differentiation from acute pancreatitis with phlegmon in the groove, since the phlegmon shows no enhancement [23]. Acute pancreatitis is associated with elevations in pancreatic enzymes (amylase and lipase), which are usually normal or minimally elevated in GP [7, 23].

In conclusion, although groove pancreatitis is a rare form of pancreatitis, radiologists should be aware of this condition and always include this entity in the differential diagnosis of a soft tissue mass in the pancreatoduodenal groove. MRI findings, although not pathognomonic, can give important clues to the diagnosis, playing a crucial role in the management of this disease.

TEACHING POINT

MRI may play a crucial role in the diagnosis of groove pancreatitis. The diagnosis should be sought when a mass in the pancreatoduodenal space presents with features of fibrotic tissue, frequently in association with duodenal wall thickening, cysts, and regular tapering of the pancreatic and common bile ducts.

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FIGURES

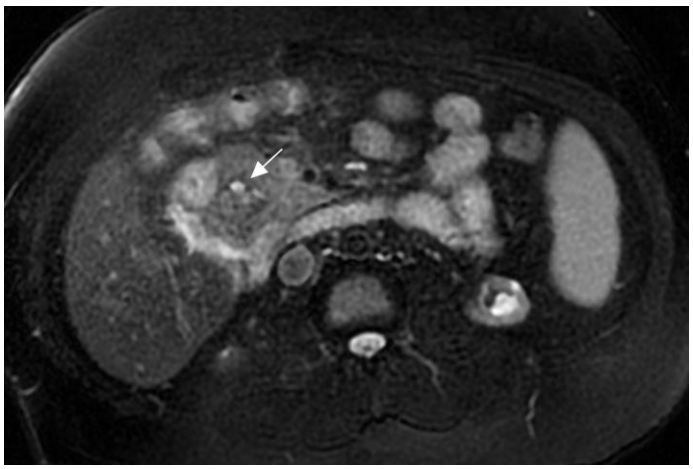
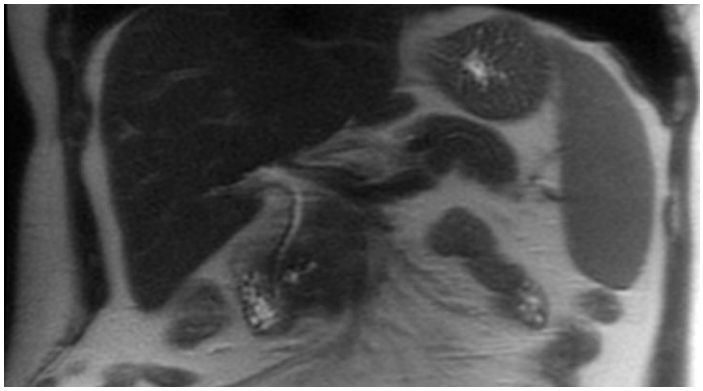


Figure 1a



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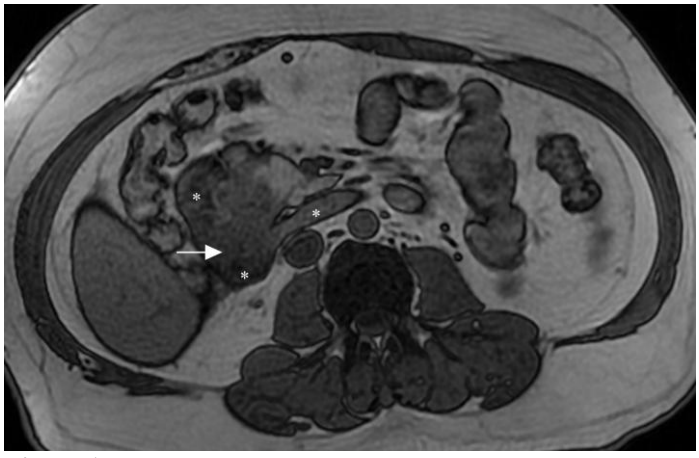

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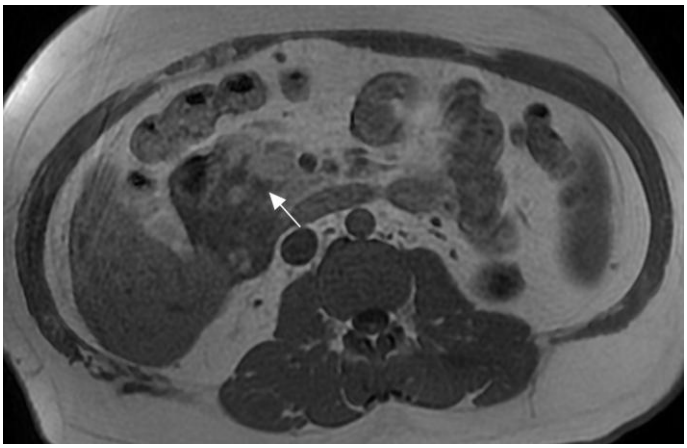


Figure 1d

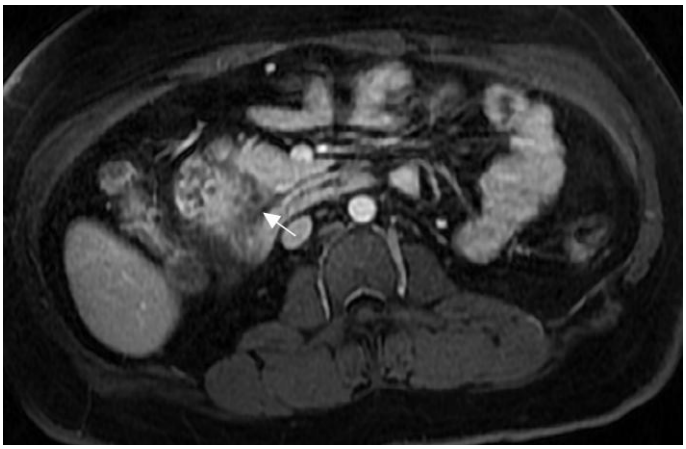
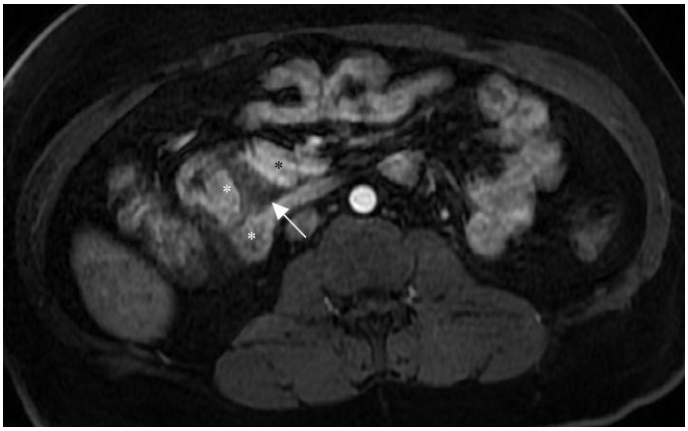


Figure 1f



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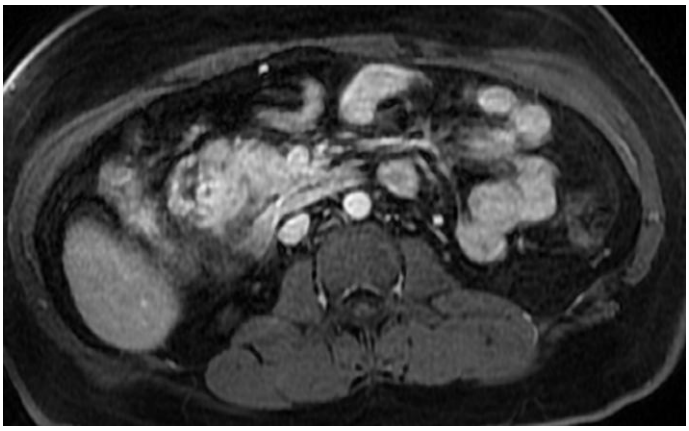

Figure 1g

Figure 1: A 27 year-old male with groove pancreatitis. Abdominal MRI. Transverse (a) and coronal (b) T2-weighted half-Fourier single-shot turbo spin-echo (SSTS-SE) images with and without fat-suppression, precontrast out-of-phase and in-phase 2D breath-hold dual echo gradient recalled echo (c, d), and postcontrast 3D-GRE fat-suppressed T1-weighted sequences in the transverse plane on the arterial (e), portal venous (f) and delayed (g) phases. The T2-weighted images demonstrates slightly hypointense sheet-like mass in the pancreatoduodenal groove, with cystic changes (arrow, a), and mild dilatation of the common bile duct with long and smooth tapering (b); The T1-weighted images shows an hypointense sheet-like mass (arrow, c) bordered by the duodenum (white *, c) and extending into the pancreatic head (arrow, d). On immediate postgadolunium image is observed imperceptible enhancement (arrow, e) in the mass located between the duodenum (white *, e) and the pancreatic head (black *, e). On the portal venous phase is appreciated patchy enhancement (arrow, f), and greater enhancement is demonstrated on the delayed phase (g). (Parameters - Field strength: 1,5 T; T2 SSTS-SE: TR - 1500, TE - 85; T1 in/out-of-phase: TR - 170, TE - 2.2/4.4; T1 3D-GRE FS post-contrast: TR - 3.8, TE - 1.7; Contrast: MultiHance , Bracco Diagnostics, Milan, Italy, at 2 ml/s followed by a bolus 20 ml of saline flush)

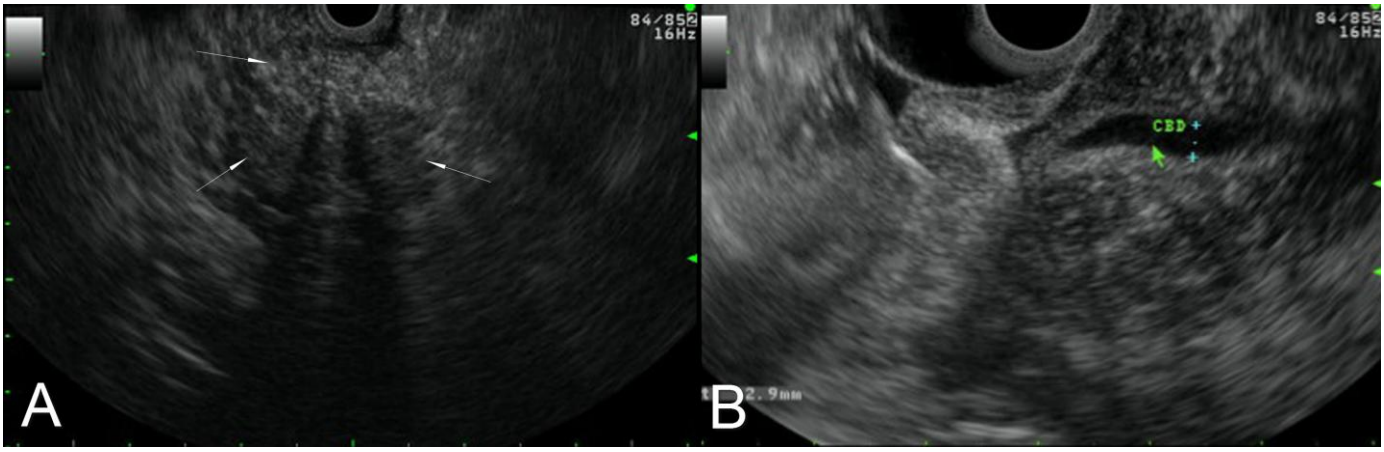

Figure 2: A 27 year-old male with groove pancreatitis. Endoscopic ultrasound demonstrates a heterogeneous and predominantly hypoechoic mass (arrows, a) with scattered calcifications and poorly defined margins located between the pancreatic head and the duodenum (a, b), mild dilatation of the common bile duct is appreciated with long and smooth tapering in the distal third (b). (Transducer frequency - 7.5 MHz).

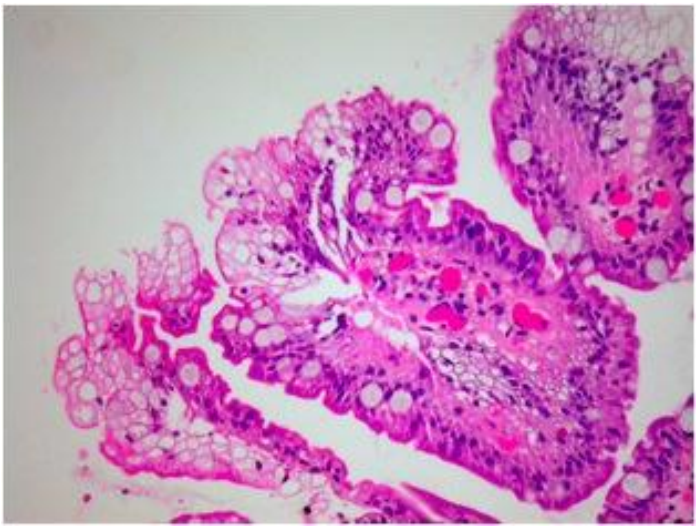

Figure 3 (left): A 27 year-old male with groove pancreatitis. Microphotography shows marked hyperplasia of Brunner's glands in duodenal wall, mild villosities atrophy and inflammation. No malignant cells were recognized (HE stain).

Etiology	Unknown, probably multifactor
Incidence	2,7-24,5% of surgical series from patients with chronic pancreatitis
Gender ratio	Males > Females
Age predilection	30-50 years old
Risk factors	Alcohol abuse
Treatment	Conservative/surgical
Prognosis	Benign entity, with variable response to conservative measures
Findings on imaging	
US	Thickened duodenal wall ± proximal luminal stenosis Hypoechoic mass in groove area Irregular duodenal surface with cystic changes
CT	Sheet-like, hypodense, poorly enhancing mass between pancreatic head and thickened duodenal wall Cysts in duodenal wall, which may be difficult to appreciate if very small May have dilation of the common bile duct, usually mild and with smooth tapering
MRI	T1 hypointense and T2 hypo-iso-or slightly hyper intense sheet like mass Patchy focal enhancement on venous phase and progressive enhancement on delayed imaging Duodenal wall thickening ± stenosis Cystic lesions in the groove or duodenal wall Regular tapering of the common bile duct ± pancreatic duct, well appreciated on T2-weighted and MRCP images

Table 1: Summary table of groove pancreatitis

	US	**CT**	**MRI-T1**	**MRI-T2**	**Pattern of enhancement**
Groove pancreatitis	Thickened duodenal wall with proximal luminal stenosis; Hypoechoic mass in groove area; Irregular duodenal surface with cystic changes	Sheet-like, hypodense, poorly enhancing mass between pancreatic head and thickened duodenal wall; Cysts in duodenal wall; May have mild dilation of the CBD	Hypointense sheet like mass	Hypo-iso-or slightly hyperintense sheet like mass; Hyperintense cystic lesions in the groove or duodenal wall; May have minimal dilatation of the CBD; Thickened duodenal wall	Patchy enhancement on portal venous phase and greater delayed post gadolinium enhancement, reflecting high fibrotic content
Acute pancreatitis	Pancreas enlargement; Indistinct boundaries; Diminished echogenicity due to edema; Liquid tracking to retroperitoneal and pararenal spaces and into the lesser sac of the peritoneum;	Focal or diffuse enlargement of pancreas; Heterogeneous enhancement; Nonenhancing necrotic areas; Rim-enhancement of acute fluid collections, abscesses and pseudocysts; Infiltration of peripancreatic fat; Gallstones	Variable decreased signal intensity and enlarged gland	Fluid collections, pseudocyst, necrotic areas: Hyperintense Gallstones or intraductal calculi: Hypointense	Heterogeneous enhancement pattern; Nonenhancing decreased signal areas: necrosis/fluid collection/ pseudocyst
Periampullary carcinomas	Hypoechoic mass	Hypodense mass; Marked dilatation of the biliary ducts caused by common bile duct stricture or abrupt termination at tumor level, typically showing a shoulder sign	Hypointense mass	Hypointense mass; Marked dilatation of the biliary ducts caused by common bile duct stricture or abrupt termination at tumor level, typically showing a shoulder sign	Poor enhancement
Gastrinoma	Homogeneously hypo echoic mass	Hypodense mass with ring enhancement. Homogeneous enhancement may be seen in subcentimeter lesions; Distant disease may be seen (ex. Hypervascular liver metastases)	Hypointense mass	Hyperintense mass; Distant disease may be seen (ex. hypervacular liver metastases)	Ring enhancement. Homogeneous enhancement may be seen in subcentimeter lesions
Pancreatic Carcinoma	Hypoechoic mass; Contour deformity; Pancreatic ductal dilatation distal to tumor	Isodense mass; Post-contrast - heterogeneous, poorly-enhancing mass; Parenchymal atrophy and pancreatic ductal dilatation distal to tumor may be seen; Lesion in head may also cause CBD obstruction and dilatation of bile ducts; major vessel encasement can be seen.	Low signal intensity relative to normal parenchyma;	Variable signal intensity; Double duct sign related with pancreatic and common bile duct dilatation; Distant disease (ex. Liver metastases)	Poor enhancement, generally ring type; May extend to peripancreatic tissues and present with major vessels encasement/ obstruction

Table 2: Differential diagnosis table of groove pancreatitis

ABBREVIATIONS

MRI: Magnetic Resonance Imaging
GP: Groove Pancreatitis
GRE: Gradient Recalled Echo
MRCP: Magnetic resonance cholangiopancreatography
CBD: Common bile duct
SSTS-SE: Single-shot turbo spin-echo

KEYWORDS

Groove pancreatitis; Magnetic Resonance Imaging; MRI; Chronic pancreatitis

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