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CT and MRI assessment of symptomatic organized pancreatic fluid collections and pancreatic duct disruption: an interreader variability study using the revised Atlanta classification 2012

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Abstract

Purpose: Compare CT and MRI for fluid/debris component estimate and pancreatic duct (PD) communication with organized pancreatic fluid collections in acute pancreatitis. Evaluate fat density globules on CT as marker for debris. *Methods*: 29 Patients with 46 collections with CECT and MRI performed ≥4 weeks of symptom onset assessed for necrotizing pancreatitis, estimated percentage of fluid volume and PD involvement by two radiologists on separate occasions. T2WI used as standard for estimated percentage of fluid volume. Presence of fat globules and fluid attenuation on CT was recorded. Spearman rank correlation and kappa statistics were used to assess the correlation between imaging techniques and interreader agreement, respectively. *Results*: Necrotizing pancreatitis seen on CT in 27 (93%, κ 0.119) vs. 20 (69%, κ 0.748) patients on MRI. CT identified 42 WON and 4 pseudocysts vs. 34 WON, and 12 pseudocysts on MRI. Higher interreader agreement for percentage fluid volume on MRI ($\kappa = 0.55$) vs. CT ($\kappa = 0.196$). Accuracy of CT in evaluation of percentage fluid volume was 65% using T2WI MRI used as standard. Fat globules identified on CT in 13(65%) out of 20 collections containing $<75\%$ fluid vs. 4(15%) out of 26 collections containing $>75\%$ fluid ($p = 0.0001$). PD involvement confidently excluded on CT in 68% collections vs. 93% on MRI. *Conclusion*: MRI demonstrates higher reproducibility for fluid to debris component estimation. Fat globules on CT were frequently seen in organized pancreatic fluid collections with large amount of debris. PD disruption more confidently excluded on MRI. This information may be helpful for pre-procedure planning.

Key words: Pancreatitis—Multi-detector computed tomography—MRI—Organized pancreatic fluid collections—Revised Atlanta classification 2012

The recently revised Atlanta classification differentiates organized collections in acute pancreatitis based on their composition and morphology [1]. The term pseudocyst is used for collections containing predominantly fluid, arising in the context of interstitial pancreatitis (IP), while walled-off pancreatic necrosis (WON) is a pancreatic or a peri-pancreatic fluid collection containing varying amounts of solid debris arising in the context of necrotizing pancreatitis. These collections are surrounded by a defined wall composed of granulation tissue and present as a delayed complication usually occurring after 4 weeks from symptom onset [2]. Another complication of necrotizing pancreatitis is the disruption of the main pancreatic duct (PD), which is most commonly associated with central gland necrosis. The resulting collections, due to their communications with the PD, often fail to resolve and require definitive

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treatment by indefinite indwelling cystgastrostomy stents or distal pancreatectomy to allow for drainage of secretions from any viable pancreatic parenchyma into the area of WON [3, 4]. In addition, the outcomes of endoscopic and percutaneous pancreatic collection drainage and the length of hospital stay have been shown to be related to pancreatic duct involvement [5, 6].

The management of these two types of organized collections differs because of the variable quantity of debris. Management of pseudocysts, owing to their largely fluid composition, can be drained using simple percutaneous or endoscopic techniques; however, WON requires direct endoscopic necrosectomy, insertion of large caliber cystgastrostomy metal stents, and/or percutaneous techniques that allow for irrigation and gradual drainage of necrotic debris [7–9].

Although features of clinical severity, such as persistent organ failure, may suggest the presence of WON over pseudocyst, differentiating collections on the basis of clinical severity alone is not reliable [10]. In the subacute or late morphological phase, imaging is primarily performed to assess symptomatic collections to determine whether endoscopic, percutaneous, and/or surgical drainage is required [3, 4, 11]. Any attempt to drain unrecognized necrotic debris within these organized pancreatic fluid collections with standard drainage techniques may result in decreased success rates [12] and an increased risk of infection [13]. Furthermore, specific approaches have been developed to address collections that contain varying degrees of fluid and debris including surgical or direct endoscopic necrosectomy or with the endoscopic insertion of several plastic or metal stents across one or more cystgastrostomy tracts by the endoscopist for collections with large amount of debris [14–17].

Contrast-enhanced computed tomography (CECT) is the most commonly obtained initial test to detect the presence of collections [18]. Although there is no consensus on which imaging modality to use for the assessment of organized pancreatic fluid collections, CT is commonly used to follow-up symptomatic collections and for planning therapeutic interventions. Quantification of the presence of solid debris and fat necrosis (seen as fat density globules) with in the collection, especially WON, may help assess the presence of drainable fluid before intervention. It is difficult to determine on CT the amount of fluid in a collection that contains varying degrees of fluid and necrotic debris [13, 19]. Magnetic resonance imaging (MRI) is sometimes substituted for CT in the sub-acute phase to assess the amount of fluid within the collections due to its superior soft tissue resolution, as well as to evaluate the integrity of the pancreatic duct. A prior study advocated the use of predrainage MRI for sub-acute pancreatic collections [20] to avoid infection from unrecognized debris after predicting the drainability on MRI, CT, and ultrasound prior to drainage. However, the study lacked the assessment of interreader variability, identification of pancreatic duct communication with the collections and the use of the revised Atlanta classification terminology. Furthermore, the utility of CT findings that may help in predicting the drainability of these collections were not addressed.

The aim of this study was to assess the reproducibility of CT and MRI findings for debris assessment and presence of ductal communication with fluid collections by radiologists in patients with symptomatic organized pancreatic fluid collections in the setting of acute pancreatitis. We hypothesized higher reproducibility of MRI for these two findings and a higher incidence of fat density globules on CT in collections with larger amount of debris. This information may be valuable when intervention is contemplated.

Materials and methods

Study population

This retrospective study was approved by our Institutional Review Board with waiver of informed consent and Health Insurance Portability, and Accountability Act authorization.

Patients who had a history of acute pancreatitis and had both MRI and CT performed, were identified using ICD 9-CM (The International Classification of Diseases: Ninth Revision, Clinical Modification) diagnosis code based on a query of an administrative database, from January 1993 to September 2013. Patients with pseudocysts and WON were identified using both ICD-9-CM diagnosis code 577.2 (cyst and pseudocyst of pancreas) and 577.0 (acute pancreatitis) as well as current procedure terminology (CPT) codes 43259, 43240, 43262, 43268, 48511, 75984, and 75989 (endoscopic and percutaneous drainage) as previously published [21]. A total of 2693 patients who had a history of acute pancreatitis were identified through these codes. Acute pancreatitis was defined as two or more of the following: serum amylase and/or lipase level greater than or equal to three times the upper limit of normal (normal amylase: (28–100 IU/L, lipase: (16–63 IU/L), characteristic upper abdominal pain, and CT findings of acute pancreatitis. All patients with reported organized pancreatic fluid collections and having undergone both contrast-enhanced CT and MRI performed after 4 weeks of symptom onset were included. Only patients with contrast-enhanced CT and contrast-enhanced MRI performed within 7 days of each other were included in the study. These images were then interpreted by a radiologist to exclude any patients with an indwelling stent or catheter or presence of calcifications within the collections to avoid streak artifact that may hinder the fluid attenuation evaluation using Hounsefield units (HU) measurement. A total of 29 patients (19 men and 10 women; age

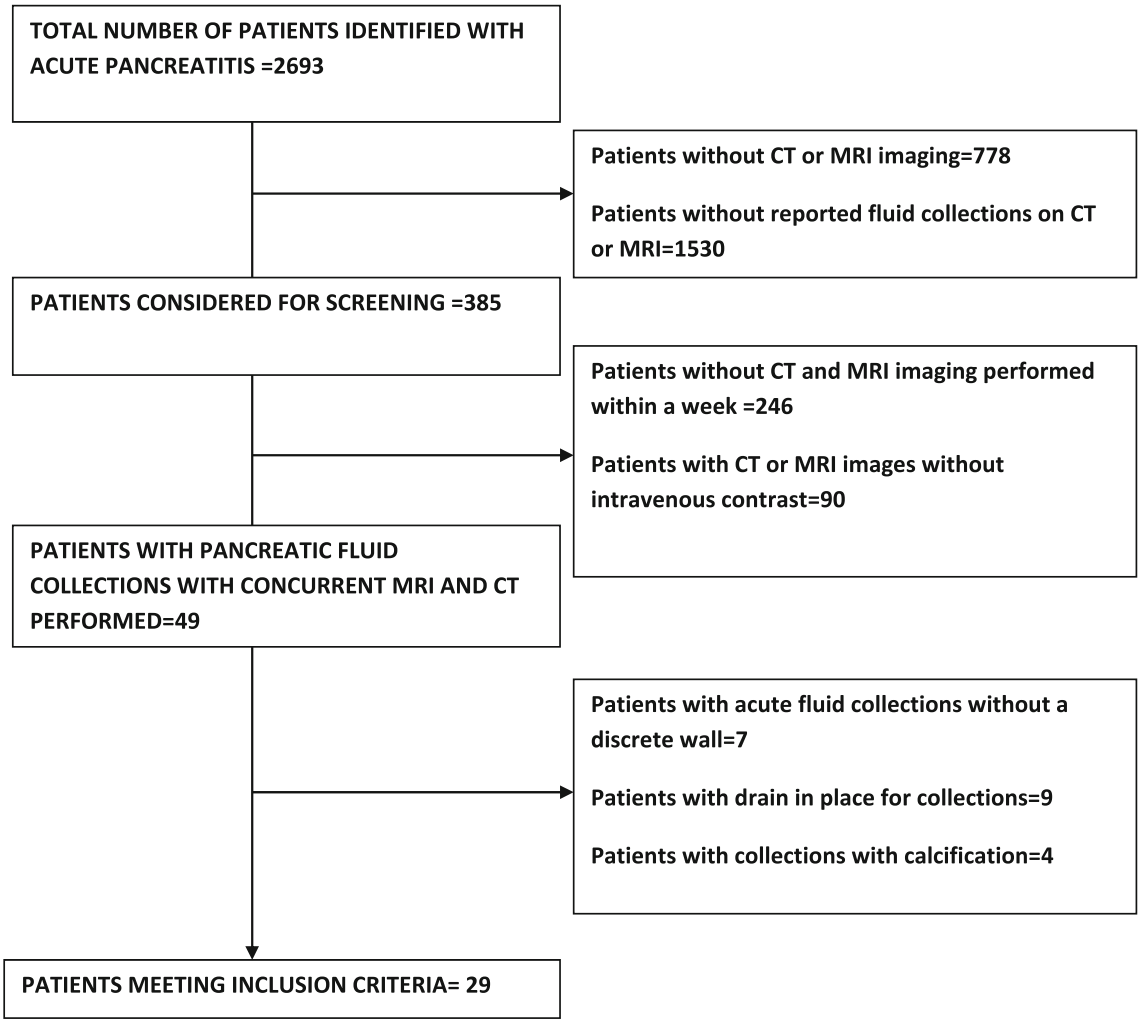

Fig. 1. Flowchart displaying the inclusion and exclusion criteria for the study cohort.

range, 17–78 years) met criteria for further analysis (Fig. 1).

Technique

Computed tomography (CT). Contrast-enhanced CT (CECT) of the abdomen was performed using pancreas protocol involving a dual phase (i.e., arterial and venous phases) imaging with thin slices using multi-detector CT. Axial images of the abdomen were acquired at 25–30 s (arterial phase) and 60 s (portal venous phase) after administration of IV contrast using an intravenous bolus injection of between 100 and 120 mL of iodinated contrast (Visipaque® 320 or Omnipaque® 350, GE Healthcare, Waukesha WI, U.S.A.) with water as negative oral contrast. The injection rates were routinely 4-5 mL/s with scan delays of 25–30 s (arterial phase) and 60 s (portal venous phase). Most CTs included both thin (0.75–1.5 mm) and thick (3–5 mm) slice image series, sagittal and coronal reformatted image series, and 3D post processed images.

Magnetic resonance imaging (MRI). MRI abdomen was performed with and without contrast using a standardized MRI and Magnetic resonance cholangiopancreatography (MRCP) protocol with a 1.5-T MR imager (Magnetom Avanto; Siemens Medical Solutions) using a phased-array torso coil. Transverse and coronal T2 weighted single-shot fast spin-echo (SE) imaging was performed (repetition time msec/echo time msec, 4500/92; field of view, 320 mm; matrix, 256 × 180; section thickness, 6 mm, slice gap, 1.2 mm; receiver bandwidth, 543 Hz/pixel; flip angle, 150°). T2-weighted acquisitions for the MRCP were acquired in the coronal plane and the individual slices and reconstructed maximum intensity projections were used for viewing the 3-dimensional MRCP. Multi-planar multi sequence images of the abdomen were obtained without intravenous contrast and subsequently with contrast-enhanced T1-weighted three-dimensional fat-suppressed spoiled gradient-echo imaging (repetition time ms/echo time ms, 5.77/2.77; field of view, 320–400 mm; matrix, 192 × 160; section thickness, 2.5 mm; receiver bandwidth, 496 Hz/pixel; flip

angle, 10°) in the hepatic arterial phase (20 s), portal venous phase (70 s), and delayed phase (3 min) after intravenous administration of 0.1 mmol/kg body weight of intravenous gadopentetate per kilogram of body weight, Magnevist; Bayer, Wayne, NJ).

Interpretation

CT and MRI of the patients meeting inclusion criteria were retrieved through the Picture Archiving and Communication System (PACS) using the image accession number. These images were interpreted separately by two radiologists with 14 and 4 years of cross-sectional imaging interpretation experience as attending radiologists, respectively, blinded to the clinical history and final diagnosis of the patients. The radiologists interpreted CT and MRI independently on separate occasions at least 4 weeks apart to minimize recall bias and to be blinded to the results of each modality. Each collection was analyzed individually. The largest diameter of the collections was measured on CECT and T2 weighted imaging (T2WI). Imaging characteristics such as location, estimated percentage of fluid volume (excluding solid debris) with in the collection upon visual inspection (categorized as 0–25%, 26–50%, 51–75%, and 76–100%) were assessed. Solid debris was defined as material with higher attenuation than the surrounding fluid and/or areas of fat attenuation on CT. T2WI, due to its fluid sensitivity, was used to assess the amount of fluid and debris. The debris was defined as any area that does not have the typical bright fluid signal on T2 weighted imaging. This also included blood products, appearing as areas of high signal intensity on pre-contrast T1WI. The presence of fat density globules, defined as foci of fat attenuation, within the collection was recorded on CT. Evidence and degree of necrotizing pancreatitis was also assessed on both CT and MRI using MCTSI criteria [22], [23]. Presence or absence of pancreatic necrosis was assessed and the collections were categorized as pseudocysts when associated with IP and WON in the presence of pancreatic necrosis using the revised Atlanta classification definitions by assessing enhancement of pancreas on both CECT and post contrast T1WI [1]. Collections that were in the pancreas or in close proximity to the pancreas were identified by the three radiologists by consensus. The presence of ductal communication with these collections was also recorded as present, absent or an uncertain response on CT and MRI. On CT, multiplanar reconstructions were used if needed and axial T2 weighted images along with MRCP source and maximal intensity projection (MIP) images along with post contrast T1WI were used to assess the ductal integrity by identifying the presence or absence of direct communication of the main pancreatic duct with the adjacent collection [24]. An uncertain response was recorded in case of failure to confidently appreciate main pancreatic duct communication with a fluid collection. Any discrepancy in results between two radiologists was resolved by adjudication by a third radiologist if needed for the sake of calculation of frequency of findings.

Assessment of fluid attenuation

The CT studies were analyzed using the ImageJ image processing tool [25]. One investigator manually drew a region(s) of interest (ROI) on each of the 3 mm thickness slices of the CT study, to encompass the maximum possible area of the fluid collection of interest. Care was taken to avoid the external margins and the discontinuities within each collection. ImageJ tools were used to calculate the attenuation, measured in HU, for each slice and for each collection of interest. Average global volumetric HU of each collection on CT was calculated and then compared to its percentage of fluid volume determined upon visual inspection on MRI.

Statistical analysis

The interreader variability for CT and MRI image interpretation was calculated using the kappa (κ) analysis [26]. Λappa value less than 0.20 was considered poor agreement, 0.21–0.40 was fair agreement, 0.41–0.60 was moderate agreement, 0.61–0.80 was good agreement, and 0.81–1.00 was very good agreement. Categorical variables were compared using the Chi-Square test or Fisher's exact tests and continuous variables were compared using student's t test. Spearman rank correlation coefficient was used to evaluate the correlation between CECT and MRI for grading the quantity of fluid with in organized pancreatic fluid collections. Based on the visual estimation by the radiologists, the accuracy of percentage of fluid volume on CT was compared to T2WI MRI used as a standard. A p value of less than 0.05 was considered statistically significant. All the analysis was performed using SPSS 22 statistical software package (IBM Analytics, Armonk, NY).

Results

Frequency of findings

Among the 29 patients, 11 had multiple collections for a total of 46 collections. All collections were seen on both CT and MRI. The CT or MRI was obtained at least 4 weeks (range 4–14 weeks, mean, 5.1 weeks) after the onset of symptoms of acute pancreatitis. All collections were surrounded by a discrete wall. Necrotizing pancreatitis was identified on CT in 27 (93%) patients, while 2 (7%) patients had IP with 42 (91%) collections identified as WON and 4 (9%) collections as pseudocysts. Among these, 21 (72%) patients showed $>30\%$ necrosis. The average diameter of WON on CT was 7.3 ± 3.1 cm and that of pseudocysts was 8.2 ± 5.27 cm. Necrotizing

pancreatitis was identified on MRI in 20 (69%) patients, while 9 (31%) patients had IP. The collections were classified as WON (n = 34, 74%) and pseudocysts (n = 12, 26%) based on the presence of necrotizing pancreatitis and IP, respectively. Among these 20 patients with necrotizing pancreatitis, 16 (80%) patients showed >30% necrosis. The average diameter of WON was 7.2 ± 3.2 cm and pseudocyst was 8.1 ± 5.40 cm on MRI.

Among all organized pancreatic fluid collections (including pseudocyst and WON), more than 75% of their volume was simple fluid in 26 collections while the amount of simple fluid was less than 75% in 20 collections onT2WI. Within the 26 collections containing greater than 75% fluid, fat density globules were seen on CT in only 4 (15%) collections compared to visualization of fat density globules in 13 (65%) of the 20 collections containing less than 75% fluid (p = 0.0001) (Fig. 2).

Based on the visual estimation by the radiologists, the accuracy of CT in evaluation of estimated percentage of fluid volume was 65% using T2WI MRI as standard (Fig. 3). There was only moderate correlation between CECT and MRI for the estimated percentage of fluid volume (0–25%, 26–50%, 51–75%, and 76–100%) within pancreatic fluid collections (r = 0.567, $p < 0.001$). The radiologists identified 28 collections to be within the pancreas or in close proximity to the main PD by consensus. Of these, PD communication with a collection was confidently included or excluded in 19 (68%) collections on CT and an uncertain diagnosis was given in 9 (32%). collections (Fig. 4). On MRI/MRCP a certain diagnosis was made in 26 (93%) collections (Fig. 5) and an uncertain diagnosis in 2 (7%) collections (Table 1).

Interreader agreement

The agreement in identifying estimated percentage of fluid by volume with in the collections was poor on CT (κ 0.196) and moderate on MRI (κ 0.550). For visible fat, there was moderate agreement on CT (κ 0.549). For identifying necrotizing pancreatitis, agreement was poor on CT (κ 0.119), and good on MRI (κ 0.748). For characterizing collections as WON or pseudocyst, agreement was fair on CT (κ 0.257) and moderate on MRI (κ 0.469) (Table 2).

Assessment of fluid attenuation

The attenuation of these collections on CT gradually decreased from 29.9 ± 7.3 to 15.8 ± 7.2 HU as the estimated percentage of the volume of fluid increased from 0–25% to 76–100% within the collection as seen on T2WI (Table 3). The HU was not significantly different between collections with maximum amount of fluid vs. maximum amount of debris (Figs. 6, 7).

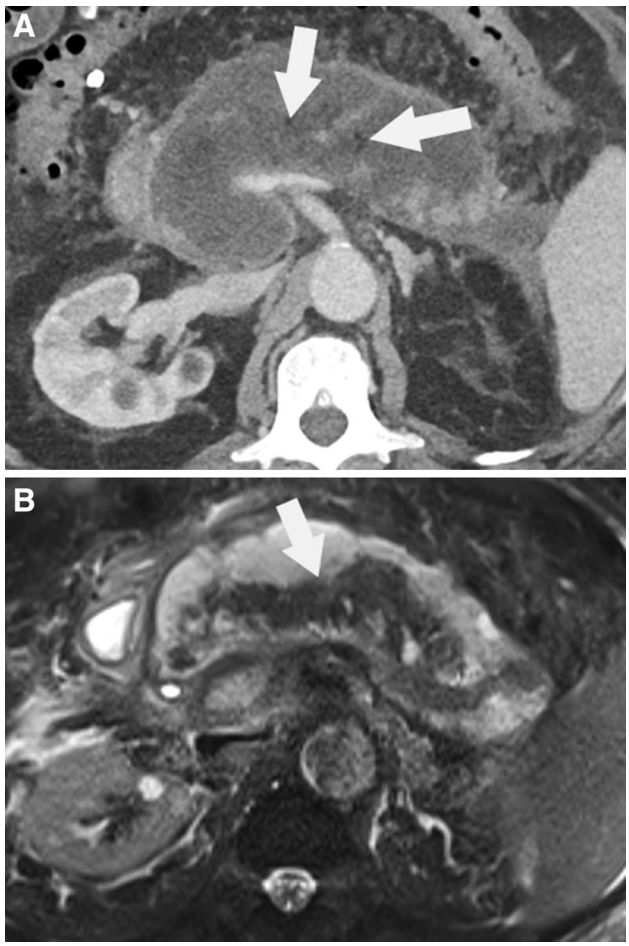

Fig. 2. 78-year-old man with severe biliary necrotizing pancreatitis. **A** Axial contrast-enhanced CT image obtained shows a large intra-pancreatic collection occupying almost the entire pancreas with sparing of the part of the pancreatic head and tip of the tail most consistent with walled-off necrosis (WON). Small globules of fat (*arrows*) are visible within the collection. **B** Axial T2-weighted MR image obtained within 3 days of the CT demonstrates large intra-pancreatic collection showing areas of fat and debris from pancreatic necrosis (*arrow*).

Discussion

Organized pancreatic fluid collections, particularly those arising in the context of pancreatic and peri-pancreatic necrosis (WON), contain a mixture of fluid and necrotic debris that may require a more aggressive management approach compared to that of simple organized pancreatic fluid collections such as pseudocysts. CT is a commonly used modality for the assessment of organized pancreatic fluid collections with increasing use of MRI in many centers for the assessment of fluid content and the integrity of the main pancreatic duct. We demonstrate higher reproducibility of MRI compared to CT in debris/fluid percentage estimation making it a more reliable study when intervention is contemplated. MRI with its

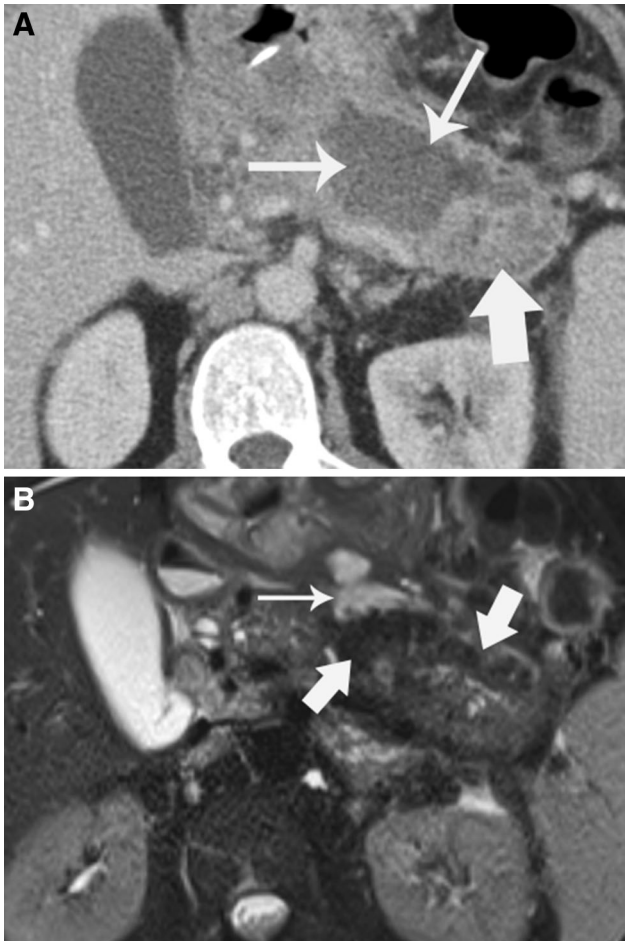

Fig. 3. 49-year-old man with severe necrotizing pancreatitis. **A** Axial contrast-enhanced CT image obtained shows a large peri-pancreatic collection (*arrow*) with apparently a large amount of fluid. The average density of the collection was 28.44 ± 18.2 HU. **B** Axial T2-weighted MRI image at the same level obtained two days later demonstrates large areas of debris (*thick arrows*) and only a small pocket of fluid (*thin arrow*).

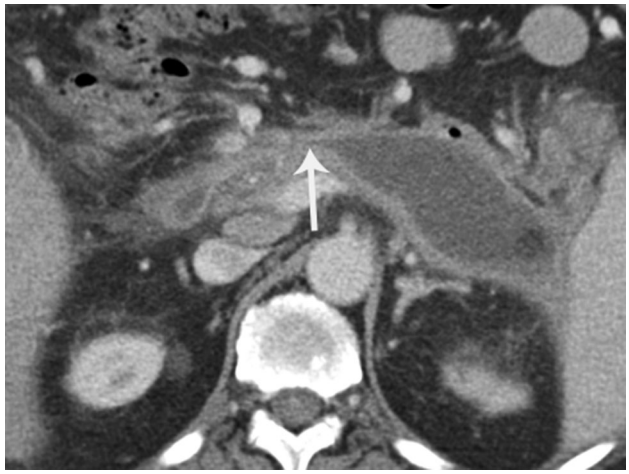

Fig. 4. 59-year-old man with necrotizing pancreatitis. Axial contrast-enhanced CT image demonstrates a large intrapancreatic collection (WON) with a communicating main pancreatic duct (*arrow*).

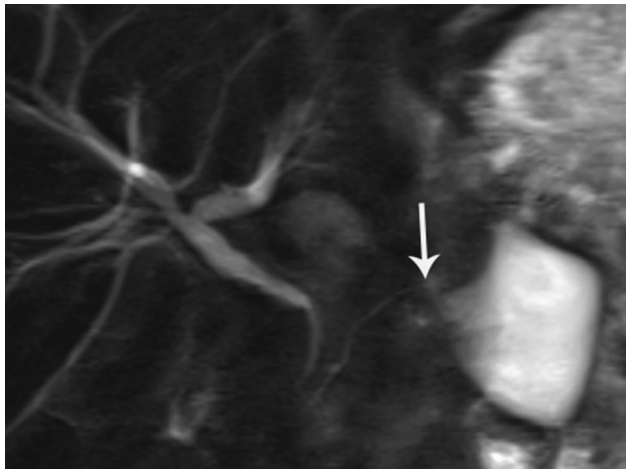

Fig. 5. 26-year-old woman interstitial edematous pancreatitis. Coronal MRCP image shows a large peri-pancreatic collection communicating with the main pancreatic duct (*arrow*).

superior soft tissue resolution provides a better differentiation of solid debris from fluid on the fluid sensitive sequences [20]. Imaging differentiation on CT, particularly the presence of debris, may be important in patients unable to get an MRI due to the presence of a metallic foreign body, claustrophobia, inability to lie in the scanner for prolonged period, etc., or at places where MRI is not readily available. In our study, the debris quantification by CT using fluid attenuation did not correlate well with qualitative evaluation on MRI using the fluid sensitive T2WI and cannot be used to discriminate between pseudocyst and WON. However, the significantly increased frequency of fat density globules on CT within collections (fat in a collection sign) with a large amount of debris compared to collections that are mostly fluid can be helpful in predicting the drainability of these collections based on the amount of fluid and debris. The fat within the collections is due to the presence of entrapped or necrosed retroperitoneal or mesenteric fat within areas of pancreatic and extrapancreatic necrosis [27]. Although the absence of fat globules does not exclude necrotic debris, detection of fat density in these collections may prompt further investigation to quantify the presence of significant debris for planning intervention. In these cases, MRI with T2WI may be helpful for this evaluation as a next step or in place of a CECT in the sub-acute phase when imaging is considered for evaluation of symptomatic organized pancreatic fluid collections. Due to better soft tissue resolution and better interreader agreement for the detection of debris within the collections compared to CECT, MRI may also have a prognostic implication in terms of risk stratification

Table 1. Comparison of CT and MR findings for ductal continuation into intra-pancreatic collection

Ductal communication with a collection (n = 28)	Present	Absent	Exclusion of ductal pathology	Uncertain diagnosis
CT findings	13	6	19	9
MRI findings	20	6	26	2

Table 2. Results for inter reader variability between two radiologists for CT and MRI findings for pancreatic fluid collections

Characteristics of collection	K value for CT readings	K value for MRI readings
Visible fat within collection	0.549	0.596
Percentage of fluid by volume in collection	0.196	0.550
Necrotizing pancreatitis	0.119	0.748
Percent pancreatic glandular necrosis	0.613	0.876
Type of collection	0.257	0.469

Table 3. Comparison between Hounsfield attenuation of collection on CT to its estimated percentage of fluid by volume as shown on MRI

Percentage fluid by volume on MRI	Global mean Hounsfield attenuation (HU)
0–25%	29.9 ± 7.3
26–50%	24.2 ± 3.9
51–75%	20.7 ± 9.6
76–100%	15.8 ± 7.2

Fig. 6. 40-year-old woman with a mediastinal pseudocyst. Axial contrast-enhanced CT image of the 7th slice of total 86 slices with region of interest (ROI) (*yellow boundary*) encompassing the maximum possible area of the fluid collection of interest. Average attenuation of the entire collection was 35.8 ± 15.46 HU. Average attenuation of this slice was 24.15 ± 36.15 HU indicative of lower attenuation in collections containing simple fluid as compared to collections with debris.

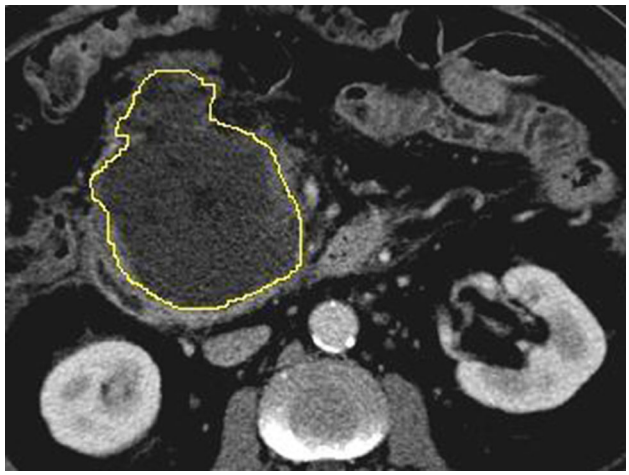

Fig. 7. 75-year-old man with a large WON. Axial contrast-enhanced CT image of the 35th slice of total 94 slices with region of interest (ROI) (*yellow boundary*) encompassing the maximum possible area of the fluid collection of interest. Average attenuation of the whole collection was 7.09 ± 22.97 HU. Average attenuation of this slice was 71.01 ± 71.44 HU indicative of the presence of solid content.

when diagnosing extrapancreatic necrosis without pancreatic parenchymal necrosis. This is considered to be a separate entity with fewer complications than when seen in combination with pancreatic parenchymal necrosis but with similar outcomes in the presence of infected necrosis [28], [29]. In addition, patients with extrapancreatic necrosis alone tend to have worse prognosis than patients with IP in terms of organ failure, length of hospital stay, need for intervention and mortality [30]. Prior studies have shown a stronger correlation with MRI grading of disease and patient outcome [11] and have questioned the accuracy of CT in diagnosing extrapancreatic necrosis [31], [32]. Furthermore, in the absence of pancreatic parenchymal necrosis, small peri-pancreatic organized pancreatic fluid collections may be interpreted as pseudocysts on CT, resulting in underestimation of extrapancreatic necrosis. These extrapancreatic collections may contain higher amount of debris compared to pseudocysts which is better visualized on T2WI.

Another important complication of necrotizing pancreatitis is the disruption of the pancreatic duct which is commonly associated with central gland necrosis [33, 34]. The lower frequency of uncertain diagnosis on MRI/MRCP for exclusion of ductal pathology compared to CT seen in our study highlights the importance of this technique for identifying ductal fistula as these collections fail to resolve due to the secretion of pancreatic juices from viable pancreatic parenchyma. Endoscopic retrograde cholangiopancreatography (ERCP) remains the gold standard for detection of PD disruption but is limited by its invasive nature and potential complications such as post-ERCP pancreatitis [35]. The accuracy of

MRCP to assess ductal disruption has been shown to be up to 94% in detecting PD disruption using ERCP as the gold standard [36]. Although we did not study the accuracy of MRCP compared to ERCP in our study, we highlight the higher level of a certain diagnosis on fluid sensitive MRI sequences for detection of ductal integrity compared to CT.

There are several limitations of this study including a small sample size, retrospective design and the lack of evaluation of clinical outcome of these collections. The standard practice at most institutions is serial CT imaging to follow-up patients with severe acute pancreatitis; therefore, even among a large cohort of patients at our institution, only a small number of patients had both a CECT and a contrast-enhanced MRI obtained within a short period of time from each other largely due to increasing reliance on MRI for management decisions. Also, a large number of patients could not be added to our study due to the absence of contrast-enhanced examinations which may be related to acute or chronic renal failure, precluding the evaluation of pancreatic necrosis. Despite the small sample size, to the best of our knowledge, no prior study has assessed CT and MRI for interreader variability in the estimation of fluid/debris quantification and compared CT with MRI for diagnosing PD communication with organized fluid collections using the revised Atlanta classification definitions. Another limitation was the use of T2WI as gold standard for the prediction of the amount of fluid instead of surgical or endoscopic data. A correlation of preprocedural/operative MRI debris quantification with surgical or endoscopic data after drainage of these collections was not addressed in our study and is subject to further investigation. In the past, Morgan et al. demonstrated higher sensitivity of MRI for detection of solid debris compared to CT (100% vs. 25%) [20]. However, this was calculated on the basis of clinical outcome of successful (non-surgical drainage with small-bore catheter without irrigation) or unsuccessful drainage (surgical drainage and/or aggressive drainage techniques) using 1 cm as a cut-off for the presence of significant debris on imaging. Due to the heterogeneous appearance of debris within a collection, we estimated the total amount of fluid and debris, albeit with visual inspection, to provide a more comprehensive composition of these organized collections. Although, we did not compare our data with clinical outcome of drainage, we used T2WI as a standard for quantification of fluid and debris based on the superior soft tissue resolution and higher accuracy of MRI in the assessment of debris compared to CT [20], [37], [38]. As an internal validation, a trend for proportional increase in the global mean collection attenuation on CT was seen with increasing amount of debris seen on MRI. However, this correlation did not reach statistical significance which may be related to a small sample size and future investigations with large a sample and with pixel analysis may be helpful. The poor agreement on identification of necrotizing pancreatitis on CT in our cohort may be due to a selection bias of patients with severely complicated acute pancreatitis with equivocal imaging findings on the initial CT and requiring repeated imaging. Furthermore, greater reproducibility of detection of necrotizing pancreatitis on MRI was demonstrated in our study as previously seen [39].

In conclusion, MRI/MRCP may serve as a modality of choice as either a first line of investigation for treatment planning for symptomatic fluid collections associated with acute pancreatitis to assess drainability and for the assessment of PD integrity. MRI was superior to CECT for the interreader agreement on complexity of pancreatic collections associated with acute pancreatitis, and in particular might be helpful in depicting the extent of debris within complex collections when fat globule are seen on CT in patients with symptomatic collections requiring drainage.

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