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Novel concepts in diagnostics and treatment

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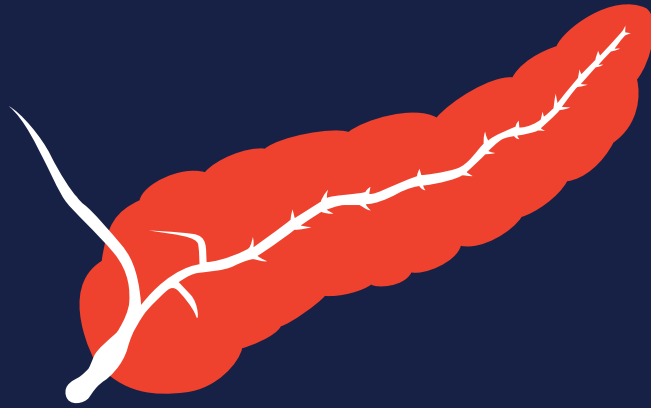
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CHAPTER 3

COMPUTED TOMOGRAPHY VERSUS MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY: A HEAD-TO-HEAD COMPARISON IN PATIENTS WITH CHRONIC PANCREATITIS

Y. Issa, U.A. Ali, T.L. Bollen, M. van der Hoek, Y.C. Keulemans, H.C. van Santvoort, C.Y. Nio, M.A. Boermeester

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ABSTRACT

Purpose
Imaging of pancreatic morphology is a crucial part of the diagnostic and therapeutic evaluation of patients with chronic pancreatitis (CP). Here, CT and MRI features of CP were compared head-to-head, and interobserver agreement was assessed.

Methods
Consecutive patients with CP from two referral centers were registered, and a head-to-head comparison was made in patients who had undergone both CT and MRI, with a maximum of 6 weeks apart. Patients who had undergone previous endoscopic or surgical intervention for CP were excluded. Two experienced radiologists independently reviewed all imaging.

Results
Seventy-five patients were included. Median duration between CT and MRI was 8 days (range 2-27). CT, as compared with MRI, found more often peripancreatic infiltration (76% vs 55%, P=0.001), parenchymal calcifications (63% vs 7%, P<0.001), intraductal stones (47% vs 29%, P=0.01). MRI compared with CT detected significantly more often pancreatic atrophy (59% vs 41%, P0.001), PD strictures (71% vs 39%, P<0.001), upstream dilatation caused by PD strictures (65% vs 40%, P=0.001), visibility of side branches (81% vs 16%, P<0.001). For CT, the interobserver agreement was almost perfect for parenchymal calcifications, intraductal stones (>0.80), and poor to moderate for pancreatic atrophy, PD strictures (<0.60). For MRI, the interobserver agreement was almost perfect for focal enlargement, pseudocysts (>0.80) and poor to moderate for PD strictures and peripancreatic infiltration (<0.60).

Conclusion
CT and MRI are complementary imaging modalities for CP. CT is best for assessment of acute episodes of CP, evaluation of parenchymal calcifications and intraductal stones. Conversely, MRI is best for diagnosis of CP in equivocal cases and for evaluation of ductal pathology.

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INTRODUCTION

Imaging is an indispensable and crucial part of the diagnostic and therapeutic evaluation of patients with chronic pancreatitis (CP). In the past, endoscopic retrograde cholangiopancreatography (ERCP) was the most accurate and widely available diagnostic modality. ERCP, however, is an invasive procedure and carries a relative high risk of complications, such as post-ERCP pancreatitis (1.6%-15.7%) [1-3]. Currently, ERCP is primarily used for therapeutic purposes (i.e. stenting of pancreatic duct (PD). International guidelines advise to perform primary imaging using the least invasive and widely available methods such as computed tomography (CT) or magnetic resonance imaging / cholangiopancreatography (MRI/MRCP) [4-8]. The choice of imaging modality could potentially have important consequences for diagnosis and treatment of patients with CP. The presence of intraductal stones, calcifications, or pseudocysts may dictate management strategies. Hence, a good understanding of the differences, strengths, and limitations of CT and MRI can improve individual clinical-decision making in patients with CP.

Although CT is an accurate imaging modality for patients with CP and is currently the most widely used imaging procedure in the diagnostic and therapeutic evaluation, it carries the risk of radiation burden due to (repetitive) CT scanning [9]. Alternatively, MRI was used predominantly as a non-invasive imaging modality for patients in whom CT was contra-indicated or showed equivocal findings [10-12]. In recent years, MRI is increasingly used, both as replacement of and complementary to CT, in patients with CP. For pancreaticobiliary disease in general, MRI has been found useful in depicting pancreatic ductal anatomy (e.g. dilatation, divisum), detecting strictures, and detecting pancreatic complications such as pseudocysts and fistulas [13-15]. Despite the abundance of reports in literature on the use of CT and MRI for CP assessment, a comparative analysis between these two modalities is still lacking.

In this study, we compared CT with MRI in patients with CP to evaluate differences in characterization of type and extent of CP and interobserver agreement.

METHODS

Patient selection

We identified all consecutive patients with CP from two Dutch academic medical centers (Academic Medical Center Amsterdam and University Medical Center Maastricht) using the CARE (Chronic Pancreatitis Registry) database from 2010 to 2014 [16], and patient administration systems, from 2004 to 2014. We included all patients who met the Mannheim criteria for CP and who had both undergone contrast-enhanced CT and MRI within a period of maximum 6 weeks apart (to keep any morphological changes to a minimum) prior to any endoscopic or surgical intervention [17]. We excluded patients who had undergone endoscopic or surgical intervention for CP before imaging and those who developed an episode of acute pancreatitis in between CT and MRI (Figure 1).

Evaluation of imaging studies

For each patient, both CT and MRI studies were reviewed independently by two experienced abdominal radiologists with specific interest in pancreatic disease, using a standardized case record form (CRF). The CRF contained pancreatic findings (e.g. PD diameter, stones, strictures,

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calcifications) and peripancreatic abnormalities (e.g. fat infiltration, pseudocysts) (Appendix). Both radiologists were blinded to clinical data and treatment of patients. To prevent recollection of imaging features of the same patient, all CT and MRI studies were presented in a random order and with an interval of at least 4 weeks. All the variables of the CRF were predefined by both radiologists. After single reader evaluation was completed, discrepancies between both radiologists were resolved by consensus (table 1).
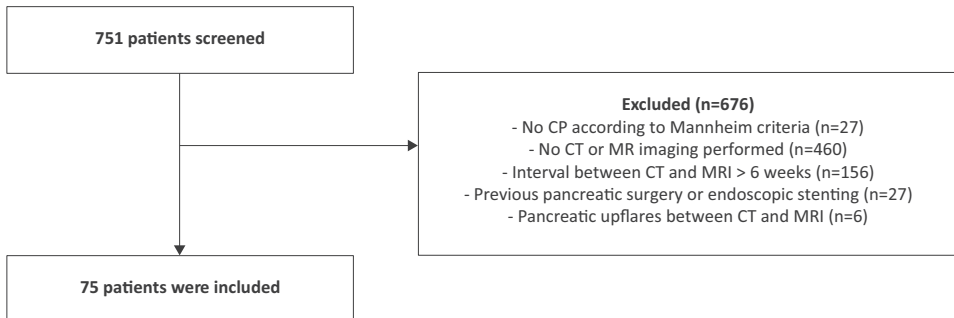
Figure 1. Flow-chart patient selection


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┌─────────────────────────────┐
│   751 patients screened     │
└─────────────────────────────┘
              │
              │        ┌──────────────────────────────────────────────────────┐
              ├───────▶│                  Excluded (n=676)                    │
              │        │  - No CP according to Mannheim criteria (n=27)       │
              │        │  - No CT or MR imaging performed (n=460)             │
              │        │  - Interval between CT and MRI > 6 weeks (n=156)     │
              │        │  - Previous pancreatic surgery or endoscopic stenting (n=27) │
              │        │  - Pancreatic upflares between CT and MRI (n=6)      │
              │        └──────────────────────────────────────────────────────┘
              ▼
┌─────────────────────────────┐
│ 75 patients were included   │
└─────────────────────────────┘
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Table 1. Definitions of variables evaluated

Pancreatic atrophy	Parenchymal volume loss of a part of the pancreatic head, body, and/or tail
Pancreatic parenchymal calcifications	CT: Hyperdens configurations in the pancreatic parenchyma MRI: signal void filling defects in the pancreatic parenchyma
Pancreatic intraductal stones	CT: Hyperdens configurations in the PD MRI: signal void filling defects surrounded by high signal pancreatic secretions in the PD with confirmation on MRCP sequence
PD strictures	Focal change in caliber of the PD with upstream dilatation
Compression of duodenum	Compression of duodenum and visible as distention of the stomach
Compression CBD	Focal change in caliber of the CBD with upstream dilatation (i.e. > 8 mm in patients with gallbladder in situ and > 10 mm in patients with cholecystectomy)
Peripancreatic infiltration	Heterogeneous area with partly fat components and partly fluid density
Pseudocyst	Well circumscribed peripancreatic fluid collection of homogeneously low attenuation, that is surrounded by a well-defined wall and contain no non-liquefied components

PD= pancreatic duct, CBD= common bile duct

CT and MRI protocol

CT: variation in protocol among included patients, but all were pre- and postcontrast enhanced studies and deemed of good quality by both observers.

MRI: variation in protocol among included patients. In all studies at least the following sequences had to be present: T1-weighted sequence (with or without fat-suppression), T2-weighted sequence, 2D or 3D MRCP sequence. Series post-gadolinium or use of secretine-enhanced sequences was lacking in majority of included studies. Given the items chosen for assessment, these post contrast series were not mandatory for inclusion. All included MRI studies were deemed of sufficient quality for CP evaluation by both radiologists.

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Study outcomes

We evaluated which modality (CT or MRI) was best for assessment of clinically meaningful and characteristic findings of CP. To this end, we focused on the following features: abnormalities of the PD (i.e. stenosis or strictures, intraductal stones, dilatation), focal enlargement of the pancreatic head, parenchymal abnormalities (i.e. pseudocysts and calcifications), and complications associated with CP (e.g. extrinsic compression on common bile duct (CBD)).

Statistical analysis

CT and MRI were compared for all study outcomes. Continuous data were presented as mean ± standard deviation (SD) and in case of non-normal distributions as median with interquartile range (IQR). Differences were analyzed using the Wilcoxon signed rank test for non-normally distributed continuous paired data and the McNemar test for dichotomous outcomes. A 2-sided P value of <0.05 was considered statistically significant. Interobserver agreement for CT and MRI findings was analyzed using Kappa statistics (K) [18]. Intraclass correlation coefficient was used for continuous variables with a two-way mixed model, type absolute agreement, with output using a single measure. We also calculated the observer agreement (Po), which is the proportion of cases for which both raters agreed on. Furthermore, we calculated a prevalence-adjusted, bias-adjusted K (PABAK, 2*Po-1) [19]. Kappa's statistics will be distorted and becomes less meaningful when prevalence of variables is not equally distributed [19]. A PABAK is particularly useful in cases with high percentage agreement but a low Kappa. For interpretation of Kappa and PABAK, we adopted the standard descriptive scale by Landis and Koch for strength of agreement: poor <0.00, slight 0.01-0.20, fair 0.21-0.40, moderate 0.41-0.60, substantial 0.61-0.80, almost perfect 0.81-1.00 [20]. Analyses were performed with SPSS version 20.0 (Chicago,IL).

RESULTS

Patients

A total of 751 patients with CP were identified and screened for eligibility by using patient administration systems (billing records) at two academic centers. Of these, 676 patients were excluded for the following reasons: no CT and/or MRI was performed (n=460), patients did not fulfil the Mannheim criteria for CP (i.e. diagnosis of recurrent acute pancreatitis, n=27), interval between CT and MRI was more than 6 weeks (n=156), patients with a prior history of pancreatic surgery or endoscopic stenting of the PD (n=27), patients with one or more pancreatic upflares between CT and MRI (n=6) (figure 1). Seventy-five patients formed the final study population.

Patient characteristics are given in Table 2. The majority of patients were male and had alcoholic or idiopathic CP. Around a quarter of patients had endocrine and exocrine insufficiency. Median interval between CT and MRI was 8 days (range 2-27 days), of which 48% (n=36) was made within 1-week interval and 20% (n=15) on the same day (table 2).

CT versus MRI

Imaging features for CT and MRI for these CP patients are listen in table 3. CT, as compared with MRI, found significantly more often the presence of peripancreatic infiltration (76% vs. 55%), parenchymal calcifications (63% vs. 7%), intraductal stones (47% vs. 29%), diameter of intraductal stones (8.5 mm vs. 6.8 mm), and upstream dilatation caused by the intraductal stone(s) (45%

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vs. 28%), respectively. MRI compared with CT detected significantly more often the presence of pancreatic atrophy (41% vs 59%), PD strictures (39% vs 71%), upstream dilatation caused by PD strictures (40 vs 65%), visibility of side branches (16% vs 81%), and communication of pseudocyst with the PD (11 vs 24%) (table 3).

Table 2. Patient characteristics

	N=75
Age in years - mean (±SD)	51 (±11)
Sex - males (%)	56 (75%)
Body mass index – mean (SD) (n=41)	22.7 (±3.1)
Etiology	
- Alcoholic	39 (52%)
- Idiopathic	24 (32%)
- Other (e.g. biliary, hereditary)	12 (16%)
Pancreatic function	
- Exocrine insufficiency	19 (25%)
- Endocrine insufficiency	21 (28%)

Table 3. Comparison of CT versus MRI

	CT N (%)	MRI N (%)	P-value
Pancreatic head diameter (mm)			
- Anterior-posterior (median, IQR)	33 (29-41)	32.5 (28-38)	0.017
- Left-right (median, IQR)	40 (34-46)	40 (34-44)	0.13
Pancreatic Atrophy n (%)	31 (41%)	44 (59%)	0.001
Calcifications n (%)	47 (63%)	5 (7%)	<0.001
Pancreatic duct			
- Max diameter (mm) (median, IQR)	6.5 (4.5-9.0)	7.0 (3.8-9.5)	0.11
- Side branches (%)	12 (16%)	61 (81%)	<0.001
Intraductal stones n (%)	35 (47%)	22 (29%)	0.01
- Diameter largest intraductal stone (mm) (median, IQR)	8.5 (6.3-13.0)	6.8 (5.5-9.5)	0.002
- Upstream dilatation	34 (45%)	21 (28%)	0.01
Strictures n (%)	29 (39%)	53 (71%)	<0.001
- Upstream dilatation	30 (40%)	49 (65%)	0.001
Focal enlargement corpus cauda	4 (5%)	4 (5%)	1.00
Compression			
- Stomach/duodenum n (%)	12 (16%)	12 (16%)	1.00
- Common bile duct n (%)	17 (23%)	16 (21%)	1.00
Peripancreatic infiltration n (%)	57 (76%)	41 (55%)	0.001
Pseudocyst n (%)	45 (60%)	52 (69%)	0.07
- Largest pseudocyst (cm) (median, IQR)	2.5 (1.5-5.3)	2.3 (1.4-3.8)	0.86
- Communication with PD	8 (11%)	18 (24%)	0.01

Table 4. Interobserver variability of two expert radiologists CT and MRI

	CT					MRI				
	R-1	R-2	Po	Kappa (CI 95%)	Pabak	R-1	R-2	Po	Kappa (CI 95%)	Pabak
Pancreatic head (mm)										
- Ant-post (median,iqr)	35 (12)	32 (13)		§0.95 (0.90-0.98)		30 (10)	33 (13)		§0.91 (0.86-0.95)	
- Left-right (median,iqr)	37 (12)	40.0 (11)		§0.90 (0.83-0.94)		40 (10)	39 (11)		§0.87 (0.79-0.92)	
Pancreatic atrophy	41 (55%)	30 (40%)	0.77	0.56 (0.38-0.74)	0.54	52 (69%)	51 (68%)	0.77	0.47 (0.26-0.68)	0.54
Calcifications	47 (63%)	47 (63%)	0.96	0.89 (0.78-0.99)	0.92	1 (1%)	12 (16%)	0.85	0.13 (-0.11-0.37)	0.70
Pancreatic duct										
Max diam (mm)(mean,sd)	7.5 (2.8)	6.6 (3.1)		§0.85 (0.71-0.92)		7.4 (3.5)	6.5 (3.5)		§0.87 (0.69-0.94)	
Side branches (%)	12 (16%)	12 (16%)	0.84	0.50 (0.23-0.77)	0.68	45 (60%)	61 (81%)	0.76	0.45 (0.26-0.64)	0.52
Intraductal stones	35 (47%)	34 (45%)	0.91	0.81 (0.68-0.94)	0.82	23 (31%)	27 (36%)	0.81	0.58 (0.39-0.77)	0.62
Largest stone (mm)[median,iqr]	9.0 (5-13)	7.5 (6-13)		§0.18 (-0.19-0.50)		7.0 (6-10)	6.0 (3-9)		§0.51 (0.06-0.78)	
Upstream dilatation	32 (43%)	33 (44%)	0.93	0.86 (0.74-0.97)	0.86	18 (24%)	27 (36%)	0.80	0.53 (0.33-0.73)	0.60
Strictures	25 (33%)	30 (40%)	0.75	0.46 (0.25-0.67)	0.50	37 (49%)	51 (68%)	0.60	0.20 (0.00-0.41)	0.20
Upstream dilatation	23 (31%)	28 (37%)	0.77	0.50 (0.29-0.70)	0.88	35 (47%)	48 (64%)	0.61	0.24 (0.04-0.45)	0.22
Focal enlargement	3 (4%)	3 (4%)	1.00	1.00	1.00	4 (5%)	4 (5%)	1.00	1.00 (-)	1.00
Compression										
Stomach/Duodenum	21 (28%)	13 (17%)	0.76	0.33 (0.09-0.57)	0.52	15 (20%)	13 (17%)	0.84	0.47 (0.22-0.72)	0.68
Common bile duct	16 (21%)	15 (20%)	0.91	0.72 (0.52-0.92)	0.82	21 (28%)	13 (17%)	0.84	0.55 (0.33-0.77)	0.68
Peripancreatic infiltration										
Head	44 (57%)	38 (51%)	0.80	0.60 (0.42-0.78)	0.60	27 (36%)	33 (44%)	0.68	0.34 (0.13-0.55)	0.36
Body / Tail	36 (49%)	35 (47%)	0.81	0.62 (0.44-0.80)	0.62	21 (28%)	26 (35%)	0.67	0.23 (0.00-0.46)	0.34
Pseudocyst	46 (61%)	41 (55%)	0.88	0.76 (0.61-0.91)	0.76	47 (63%)	52 (69%)	0.93	0.85 (0.73-0.97)	0.86
Largest pseudocyst (cm)[med,iqr]	2.2 (1.4-4.4)	2.2 (1.4-4.5)		§0.70 (0.48-0.83)		2.5 (1.5-3.6)	2.1 (1.1-4.0)		§0.97 (0.94-0.98)	
Communication with PD	7 (9%)	8 (11%)	0.91	0.48 (0.15-0.81)	0.82	11 (15%)	23 (31%)	0.76	0.34 (0.11-0.57)	0.52

§ Intraclass correlation coefficient

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Interobserver agreement

Interobserver agreement for CT and MRI is listed in table 4. The interobserver agreement was substantial to almost perfect (0.61-1.00) for the presence of parenchymal calcifications, intraductal stones, focal enlargement of corpus or cauda, pseudocysts, and diameter of the PD and pancreatic head. Interobserver agreement was slight to moderate (0.01-0.60) for pancreatic atrophy, peripancreatic infiltration, and PD strictures.

DISCUSSION

Here, performance of CT and MRI was compared head-to-head in patients with chronic pancreatitis. In the present study, several important differences were found between CT and MRI in the description of clinically meaningful morphologic abnormalities in patients with CP. These differences may have considerable consequences for diagnosis and treatment when only one of the two modalities has been performed, especially when involving decision for and planning of invasive interventions.

CT, as compared with MRI, found more often peripancreatic infiltration, parenchymal calcifications and intraductal stones (and upstream dilatation). MRI, as compared with CT, more often visualised pancreatic atrophy, PD strictures, upstream dilatation caused by PD strictures, visibility of side branches, and communication of pseudocyst with the PD. For CT, the interobserver agreement was almost perfect for parenchymal calcifications, intraductal stones (>0.80) and poor to moderate for pancreatic atrophy, PD strictures (<0.60). For MRI, the interobserver agreement was almost perfect for focal enlargement, pseudocysts (>0.80) and poor to moderate for PD strictures and peripancreatic infiltration (<0.60).

MRI missed a significant proportion of the parenchymal calcifications and intraductal stones that were visualised by CT. Pancreatic parenchymal calcifications are considered pathognomonic for the diagnosis of CP and an important feature in many classification systems [17, 21, 22]. It has been suggested that MRI has a poor detection of parenchymal calcifications because calcium deposits of protein plugs are signal void on the MRI and are depicted better on the CT as radiopaque structures (Figure 2) [23-25].

We also observed a significant difference between CT and MRI in the diameter of intraductal stones measured. Missing these features may lead to a delay in assigning adequate treatment to patients with CP. In patients with uncomplicated painful CP with stones ≥5 mm obstructing the PD, some recommend ESWL as a first step treatment, immediately followed by endoscopic extraction of stone fragments [26]. Others recommend endoscopic treatment for retrievable PD stones, and refer for surgery in case of failure of endoscopic treatment [4,27]. Interestingly, in some patients, intraductal calculi are radiolucent on CT (i.e. not detectable), but clearly depicted by MRI (figure 3). The composition of these calculi likely precludes detection by CT as these comprise of insoluble forms of lithostathine without calcium salts [28]. Significant abnormalities of the ductal anatomy (e.g. PD dilatation and strictures) and of the pancreatic parenchyma (e.g. atrophy) were more often described on MRI. The accuracy of MRI for detecting PD abnormalities is believed to be comparable with ERCP, which is regarded the most accurate diagnostic modality for ductal anatomy assessment [12, 23, 24, 29, 30]. Furthermore, compared with CT, MRI more often showed changes

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of the pancreatic parenchyma and side branches, which might be attributed to early signs of CP (i.e. atrophy, side branch ecstasies) [31]. Early diagnosis of CP is important because it enables an earlier start of treatment, which is associated with improved long-term outcome [32].

Choosing the right imaging modality to detect morphological abnormalities in patients with CP could lead to more patient tailored care. In general, about one-third of patients with obstructive CP have PD stones and strictures, and 50% have PD strictures without stones [33]. PD strictures can cause intense pain symptoms, and depending on the size, location and the presence of an upstream dilatation, it can be treated endoscopically or surgically [26, 34-36]. Therefore, presence and extent of these abnormalities can guide therapeutic decisions in regard to timing and type of intervention.

Present study also has limitations. First, due its design the study compared two frequently used non-invasive imaging modalities in patients with CP, thereby lacking an official reference standard. A comparison between imaging modalities with comparison to a reference standard (e.g. a combination of endoscopic ultrasound, surgery and/or ERCP) would be the optimal study design. Some of the patients in this cohort indeed also underwent endoscopic ultrasound and/ or intervention such as ERCP, while others did not. The downside of having invasive modalities as reference standard is a major selection bias, since only patients with a treatment indication will undergo invasive procedures such as ERCP or surgery. Endoscopic ultrasound by itself is not an optimal reference standard, and is in clinical practice predominantly used in cases for which the very diagnosis of CP itself is uncertain and/or a neoplasm needs to be rules out. Secondly, although present study was unique in, design, number of patients, and variables assessed, both detailed CT and MRI features, using a standardized form, were reviewed retrospectively. Some MRI images were of suboptimal quality due to motion artefacts (which in a way reflects clinical practice) and in some cases a limited number of MRI sequences were available for review. For assessment of items evaluated, however, these MRI studies were deemed of sufficient quality by both radiologists. Finally, due to the nature of the study, there is a selection bias, in which patients were selected who had undergone both CT and MRI. Patients with only one imaging modality (either CT or MRI) were excluded from this study. However, this does reflect the clinical practice of referral centers which more often use CT and MRI complementary.

A major strength of this study was that all imaging was reviewed independently by two expert radiologists, blinded for the clinical background and treatment of patients, presented in a random order and using predefined variables. Furthermore, in about half of patients, CT and MRI were carried out within 1-week interval, and in all within 6 weeks, which lowers the chance of changes in pancreatic morphology.

Several important differences are found between CT and MRI in the description of common clinically meaningful morphologic abnormalities in patients with CP. A good understanding of the differences, strengths, and limitations of both CT and MRI will improve clinical decision-making in CP. CT is best for assessment of acute episodes of CP, evaluation of parenchymal calcifications and intraductal stones. Conversely, MRI is best for diagnosis of CP for equivocal cases and evaluation of ductal pathology. CT and MRI are complementary imaging modalities for CP. In patients who are candidates for planning invasive treatment, using both imaging modalities side by side may be useful in decision making.

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Figure 2. A patient with chronic pancreatitis showing parenchymal and intraductal pancreatic stones on the axial CT (A-C) (arrow), but not visible on the MRI (D-F).
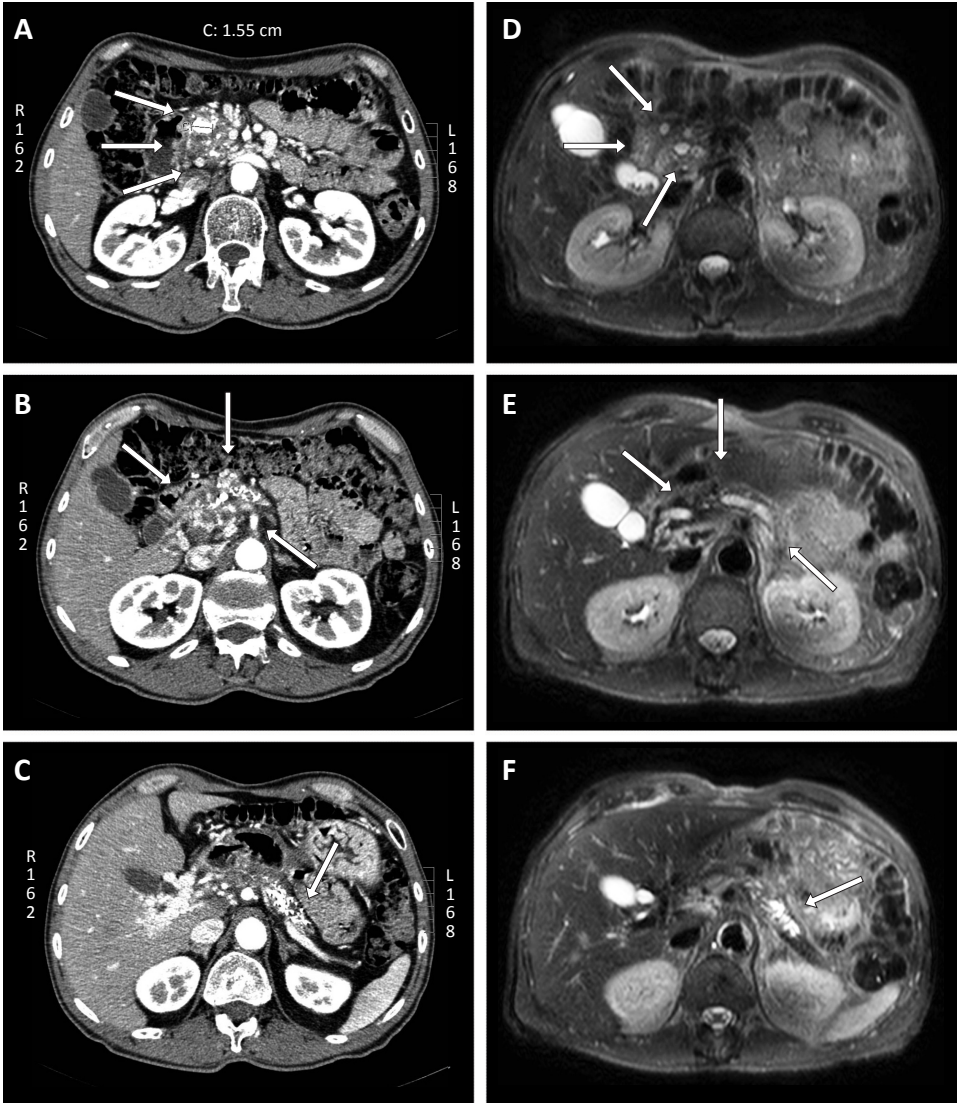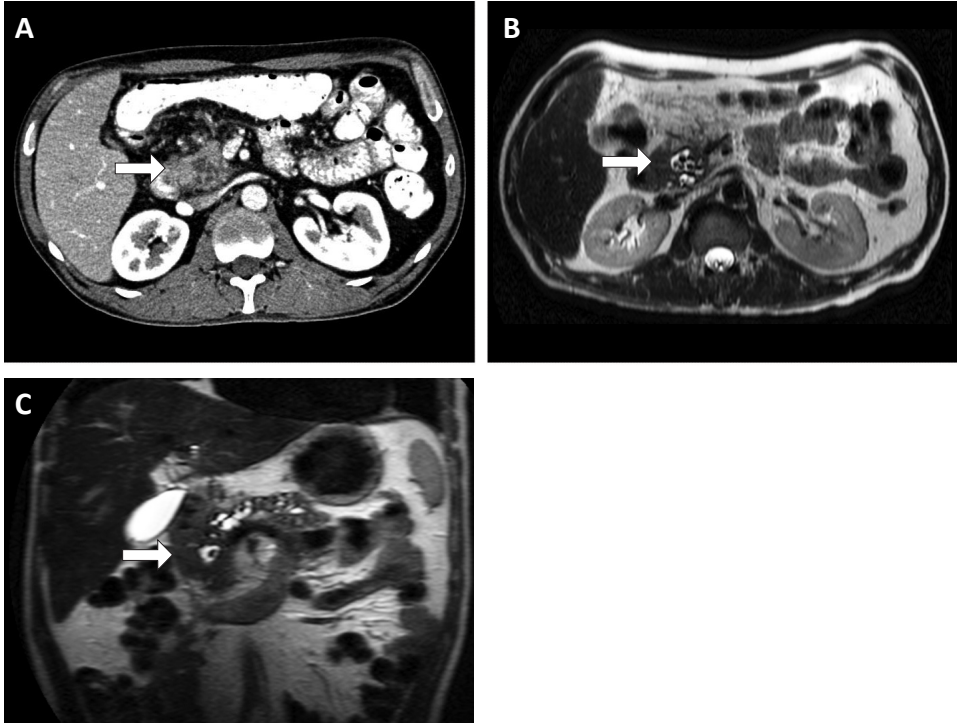
Figure 3. A-C. A patient with chronic pancreatitis showing multiple intraductal pancreatic stones in the pancreatic duct in the pancreatic head (arrow) on the axial MRI (B) image and coronal MRI image (C), but not visible on the CT (A).

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3

APPENDIX

Name: ……………………………………………

Number: |__||__||__|

Date of imaging: |__||__|-|__||__|-|__||__| (dd-mm-yy)

Type of imaging: O CT   O MRI + MRCP

_____

· Quality   O Good   O Moderate   O Poor

   Reasons (when moderate / poor)   ……………………………………………

· Diameter pancreatic head (transverse coupes):

   o Maximum diameter anterieur-posterieur |__||__| (mm)
   o Maximum diameter left-right |__||__| (mm)

· Focal enlargement
   o Pancreatic body   O Yes   O No
   o Pancreatic tail   O Yes   O No

· Relationship with surrounding structures
   o Compression stomach/duodenum   O Yes   O No
   o Compression common bile duct   O Yes   O No
   o Pressure on surrounding organs   O Yes   O No
   o Compression colon   O Yes   O No
   o Splenomegaly   O Yes   O No

3

- Pancreatic parenchym

    - o Peripancreatic infiltration pancreatic head   O Yes   O No

    - o Peripancreatic infiltration pancreatic body / tail   O Yes   O No

    - o Atrofy   O Yes   O No

        - o When present, location   O Head   O Body   O Tail

    - o Calcifications   O Yes   O No

        - o When present, location   O Head   O Body   O Tail   O Diffuse

- Pancreatic Duct (PD)

    - o Visible   O Yes   O No

    - o Normal anatomy   O Yes   O No

      When not, reason: ……………………………………..

    - o Irregular   O Yes   O No

    - o Maximum diameter |__||__| (mm)   O Not measureable

    - o Maximum in   O Head   O Body   O Tail

- Side branches PD

    - o Visible   O Yes   O No

    - o Ectasy   O Yes   O No

    - o Number of branches: …………………………………………..

- Ductal stones   O Yes   O No

    - o When present, number: O 1

      O 2

      O 3

      O 4

      O >5

    - o Lokation   O Head, ……….x

      O Body, ……….x

      O Tail, ……….x

    - o Diameter largest stone (transverse) |__||__| by |__||__| (mm)

    - o Lokation (largest stone)   O Head, ……….x

3

O Body, ……….x

O Tail, ……….x

    o   Upstream dilatation PD   O Yes   O No

·   Strictures   O Yes   O No

    o   When present, number   O 1   O 2   O, …x

    o   Lokation   O Head, ……….x

O Body, ……….x

O Tail, ……….x

O Diffuus (multiple strictures in head/body/tail)

    o   Upstream dilatation PD   O Yes   O No

·   Pseudocyst(s)   O Yes   O No

When present, lergest pseudocyst (measuring on transverse coupes)

Location: Head / Body / Tail   Diameter |__||__|,|__| by |__||__|,|__| cm

    o   Communication with PD   O No   O Yes   O Not visible

Other pseudocysts (when present)

    1.   Location: Head / Body / Tail   Diameter |__||__|,|__| by |__||__|,|__| cm

    2.   Location: Head / Body / Tail   Diameter |__||__|,|__| by |__||__|,|__| cm

    3.   Location: Head / Body / Tail   Diameter |__||__|,|__| by |__||__|,|__| cm

    4.   Location: Head / Body / Tail   Diameter |__||__|,|__| by |__||__|,|__| cm

    5.   Location: Head / Body / Tail   Diameter |__||__|,|__| by |__||__|,|__| cm

Location outside the pancreas:

    6.   Location: ………………………..   Diameter |__||__|,|__| by |__||__|,|__| cm

(largest measurement in transverse coupe)

    o   Communication with PD   O No O Not visible O Yes, location number(s):…..

·   Comments: ……

……