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Review Article

Pain assessment in chronic pancreatitis: A comparative review of methods

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ABSTRACT

Background: Patients with chronic pancreatitis (CP) frequently report chronic abdominal pain that adversely impacts their quality of life. Assessment of pain in CP is required for clinical management and clinical studies. International consensus guidelines recognized a lack of specific and validated pain assessment tools for CP. Therefore, the aim of this systematic review is to identify and compare all clinical studies that assessed pain in the context of a treatment for pain in CP.
Methods: A systematic literature search was performed in PubMed, Cochrane Library and Ovid MEDLINE. The search identified all intervention studies for pain in CP and the pain assessment tools used based on pre-defined inclusion and exclusion criteria.
Results: Of 341 articles identified, 137 studies were included. Pain assessment tools were both general and CP-specific. The latter were used in only 22 (16%) studies. Despite recommendations the aspects of pain assessed were limited and variable between tools. Validation of these tools in CP patients was limited to quality of life measures. None of the pain assessment tools evaluated duration of pain and postprandial pain.
Conclusions: There are no published pain assessment tools for CP that includes all relevant aspects of pain. There is the need to develop a comprehensive and validated pain assessment tool for patients with CP to standardised pain assessment, identify likely underlying pain mechanisms, help select appropriate treatments, report outcomes from interventions, improve clinical communication and aid the allocation of patients to clinical trials.

1. Introduction

Chronic pancreatitis (CP) is a disease characterized by progressive inflammation and scarring of the pancreas that commonly presents as chronic abdominal pain that is disabling, difficult to treat and may have a negative impact on the quality of life. Other complications of CP include diabetes, pancreatic exocrine insufficiency leading to malnutrition, weight loss and osteoporosis and psychosocial effects [1–5]. There are different patterns and aspects to chronic pancreatitis pain that reflect one or more pain mechanisms. These include mechanical, inflammatory, malabsorptive and neurogenic pain mechanisms [4,6]. There are also different treatments for pain in CP, including analgesics, enzymes, antioxidants, nutrition, radiotherapy, neuroablation, as well as endoscopic and surgical treatments [7–12]. The selection of treatments and their efficacy might be related to pain mechanisms, as well as other factors, and these require further study. The outcomes from the treatments for CP are often difficult to predict and disappointing, with patients continuing to have severe pain and a poor quality of life [13].

Many studies relating to the treatment of pain in CP are bedevilled by inadequate pain assessment, the primary endpoint. International consensus guidelines [2–4,14,15] variably recommend assessing pain duration, intensity, character, frequency, pattern, narcotic use and quality of life (QOL). It is also important to assess for chronic pain syndrome or hyperalgesia [16]. The international guidelines recommended using a variety of pain assessment methods, both general and CP-specific. These pain assessment methods evaluate a variety of different aspects of pain that might reflect different pain mechanisms and the likely efficacy

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of different treatments.

A formal comparative evaluation of the different pain assessment tools is required to determine whether they are fit for purpose, in the light of the diverse pain mechanisms and treatment alternatives. The longitudinal management of individual patients and the research of patient groups with CP requires a pain assessment tool that is accurate, reliable and easy to use, but also one that takes into account all recommended aspects of pain in order to best facilitate the identification of patients with different pain mechanisms and to help select the most effective treatment(s). The aim of this systematic review is to identify and compare all clinical studies that report interventions for pain in CP and to evaluate the aspects of pain included in the pain assessment tools. The hypothesis is that current pain assessment tools do not take into account all relevant aspects of pain and as a result there is significant room to improve on the assessment of pain for clinical management and to perform further research studies.

2. Methods

A list of all possible interventions for pain in CP was obtained from the British Medical Journal (BMJ) Best Practice [17] and review papers [7–12]. MeSH terms of the treatments were searched in PubMed and a search strategy developed. The purpose was to identify all intervention studies for pain in patients with CP and to identify the methods used for pain assessment. A systematic literature search was then conducted in PubMed, the Cochrane Library and Ovid MEDLINE for the period 1 January 1950 to 31 March 2016. The search strategy used was:

("Pancreatitis, Chronic" [Mesh] AND "Pain" [Mesh]) AND ((((((((((((((((((((((Diet therapy [Subheading]) OR "Alcohol abstinence" [Mesh]) OR "Smoking cessation" [Mesh]) OR "Analgesia" [Mesh]) OR "Pancreatic Extracts" [Mesh]) OR "pregabalin" [Supplementary Concept]) OR "Octreotide" [Mesh]) OR "Antioxidants" [Mesh]) OR "loxiglumide" [Supplementary Concept]) OR "Sphincterotomy, Endoscopic" [Mesh]) OR (("Stents" [Mesh]) AND "Pancreatic Ducts" [Mesh])) OR "Lithotripsy" [Mesh]) OR (("Decompression, Surgical" [Mesh]) AND "Pancreatic Pseudocyst" [Mesh])) OR (("Choledochostomy" [Mesh]) AND "Anastomosis, Roux-en-Y" [Mesh])) OR "Choledochostomy" [Mesh]) OR (("Pancreatic Ducts" [Mesh]) AND "Decompression, Surgical" [Mesh])) OR "Pancreaticoduodenectomy" [Mesh]) OR ((("Pylorus" [Mesh]) AND "Organ Sparing Treatments" [Mesh]) AND "Pancreaticoduodenectomy" [Mesh])) OR "Pancreatectomy" [Mesh]) OR (("Celiac Plexus" [Mesh]) AND "Anaesthetics, Local" [Mesh])) OR ("Thoracoscopy" [Mesh] AND "splanchnicectomy")) OR "Transcranial Magnetic Stimulation" [Mesh]) OR "Radiotherapy, Image-Guided" [Mesh]) OR (("Biliary Tract" [Mesh] AND "Stents" [Mesh])))

The inclusion criteria were: (1) human studies, (2) studies describing how pain was assessed in patients with CP, (3) studies that reported interventions for pain in CP and subsequent outcomes of treatment on pain, and (4) studies limited to the English language. The exclusion criteria were: (1) studies that had patients with autoimmune pancreatitis and hepatopancreatobiliary malignancy, (2) Review papers, (3) on going studies, (4) long-term follow up of previous studies, and (5) duplicate cohorts of patients. A secondary search was performed from the reference list of relevant studies and reviews for articles not identified by the primary search strategy.

Data was extracted from the included studies on the method of pain assessment, the specific aspects of pain assessed, intervention(s) used to treat pain and the outcomes of the interventions on pain.

The pain assessment tools identified from the literature were compared against the 8 aspects of pain that were considered important for pain evaluation in chronic pancreatitis as recommended by the American Gastroenterological Association (AGA) (Table 4) [14]. Eight additional aspects of pain were included, having been identified from the studies included in this review [18–20] and from international consensus guidelines [4]. These additional aspects include the description of pain, location of pain, radiation of pain, triggers/exacerbators of pain, relieving factors of pain, postprandial pain, symptoms associated with pain, and impact of pain on mental health.

3. Results

The search yielded 341 potentially eligible studies, of which 137 studies met the inclusion criteria (Fig. 1). Of the 137 studies, 37 (27%) were randomised controlled trials (RCTs). The types of interventions for pain are outlined in Table 1. The majority of interventions were surgical (64/137, 47% or which 6 were RCT's) consisting of decompression of the pancreatic duct, pancreatic resection or a combination of both. The next most common intervention were endoscopic (28/137, 20%, of which 2 were RCTs) consisting of clearing the pancreatic duct via lithotripsy or endoscopic stone removal, stricture dilation, stenting or a combination. Of the remaining RCTs in the included studies, 9 investigated analgesic drugs and 7 neuroablative procedures.

The general pain assessment tools summarised in Table 2. These tools were developed for other painful conditions and not validated in CP. For example, the McGill Pain Questionnaire (MPQ) [22] and Pain Detect Questionnaire (PDQ) [23] were validated in arthritis and lower back pain, respectively. The general assessment tools are grouped into: (i) unidimensional tools that assess one aspect of pain, of which the pain visual analogue scale (VAS) was the most common; (ii) bidimensional tools, which combine two aspects of pain; (iii) multidimensional tools that assess more than two aspects of pain; and (iv) impact of pain tools that evaluate QOL, level of disability and effects of pain on mental and emotional states. Of these general pain assessment tools, only the Medical Outcomes Study Short Form-36 Health Survey (SF-36) and Short Form-12 Health Survey (SF-12) have been validated in CP [24–26].

Each included study used at least one of these general pain assessment tools to evaluate pain in CP patients. There was no association between the characteristics of the study (e.g. type of intervention, study design, patient population and study duration) and the general pain assessment tools selected. For instance, one RCT compared the frequency of abdominal pain as the only pain assessment tool in patients receiving organ-preserving pancreatic head resection or pylorus-preserving pancreaticoduodenectomy [27]. In contrast, another RCT that evaluated the efficacy of Pregabalin used a pain VAS, Brief Pain Inventory (BPI) questionnaire and PDQ to assess pain before and after intervention [18].

The CP-specific pain assessment tools were used in 22 studies (Table 3), 7 (32%) of which were RCTs. The Izbicki pain score, used by 13 (59%) studies, focused on common aspects of pain including intensity, frequency, analgesic use and inability to work. These aspects of pain are assigned a score based on a pre-determined scale. The average of the four variables gave the final pain score, where a higher score signified worse pain. The other three tools, Ammann (used in 5 studies), Type A-E and Group 1–3 pain patterns (used in 1 study each) were developed to classify the common pain patterns in CP. These broadly refer to constant pain, intermittent pain attacks or a mixture of both with varying intensities. The Quality of life Questionnaire-Pancreatic Modification (QLQ-PAN28) (9%) was developed to complement the European Organisation for Research and Treatment of Cancer QOL questionnaire (EORTC QLQ-C30) to measure CP-specific QOL. None of these CP-specific pain assessment tools have had psychometric evaluation except the EORTC

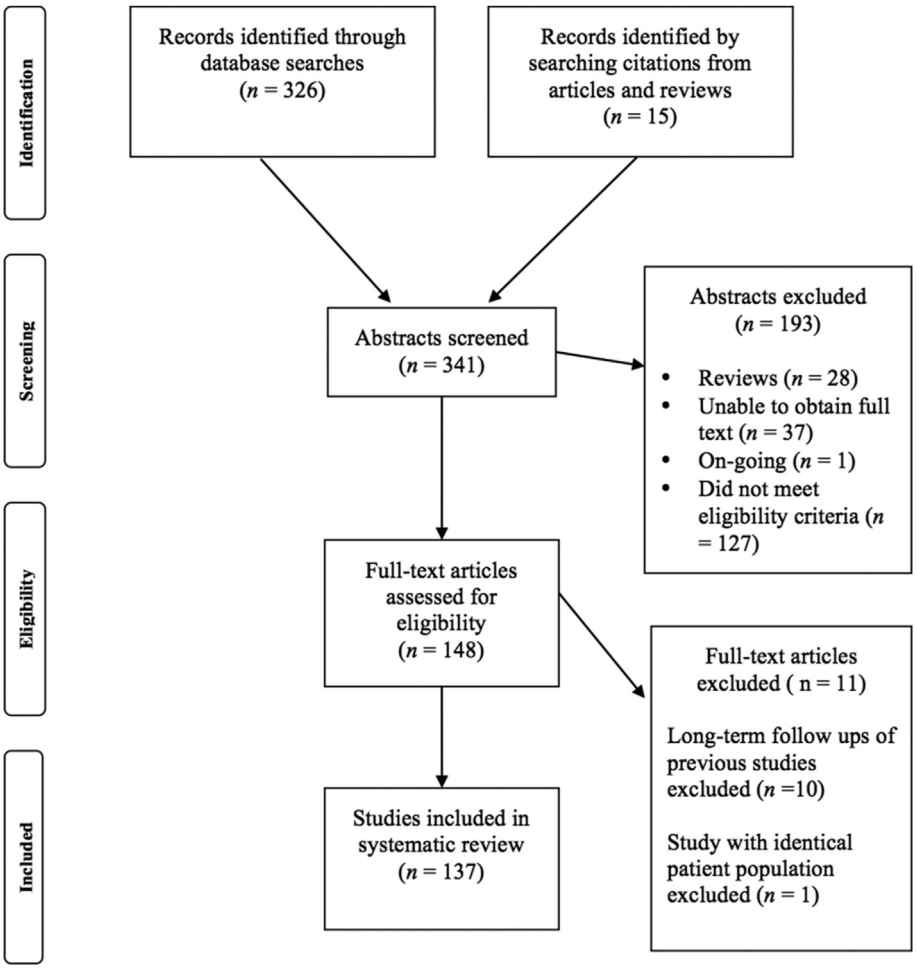

Fig. 1. Reporting items for systematic reviews and meta-analyses (PRISMA) diagram [21] for included studies.

Table 1
Types of interventions for pain in the included clinical studies of patients with chronic pancreatitis.

Type of intervention	Number of studies	Number of RCTs
Analgesic drugs	12	9
Enzymes	8	6
Antioxidants	7	6
Nutrition	4	0
Radiotherapy	1	1
Neuroablative procedures[a]	13	7
Endoscopic[b]	28	2
Surgical[c]	64	6
Total	137	37

RCTs: randomised controlled trials.
[a] Coeliac plexus neurolysis or block, thoracic splanchnic nerve division, acupuncture, transcutaneous electric nerve stimulation, spinal cord stimulation, transcranial magnetic stimulation and intrathecal narcotic infusions.
[b] Clearing the pancreatic duct via lithotripsy or endoscopic stone removal, dilating strictures, placing of stents or a combination of endoscopic approaches.
[c] Decompression of the pancreatic duct, resection of the pancreas or a combination of both.

QLQ-C30 with QLQ-PAN28 [28].

The general multidimensional tools, specific tools for CP and impact of pain tools were then compared to determine which aspects of pain were assessed (Table 4). What is clear is that the pain assessment tools are highly selective in regards to which aspects of pain are assessed and that the tools are strikingly different from each other. The aspects of pain reported by the general multidimensional and CP specific tools focused on the somatic or bodily pain experiences, while the impact of pain tools reported aspects related to QOL and emotional and mental states. The MPQ, PDQ and BPI each reported 7 out of 16 aspects of pain, which was the highest number covered of any of the tools, but the aspects of pain recorded varied between them.

It is notable that the CP-specific pain assessment tools included only 2 to 4 aspects of pain (Table 4). Further, the duration of pain (referring to length of symptomatic disease), which has been suggested to be important because of better pain relief with early surgical interventions [29,30], and presence of postprandial pain, which has been evaluated as part of the symptomology of the disease [31,32], were not assessed at all by any of the pain assessment tools. Studies commonly reported duration of pain but not as part of the pain assessment tool. Postprandial pain was sometimes reported in isolation as a binary (yes/no) scale [32–34] or pain intensity scale [31,35] but not as part of the pain assessment tool.

4. Discussion

This comparative review of pain assessment tools in patients with CP demonstrates that all aspects of pain are not considered and that the tools are highly variable. The general pain assessment tools were developed for other diseases and the CP-specific pain assessment tools were limited to only 2–4 aspects of pain. This

Table 2
General pain assessment tools used in the included clinical studies of patients with chronic pancreatitis. These tools were not developed specifically for the assessment of pain in chronic pancreatitis.

General pain assessment tools	Number of studies	Number of RCTs	Reference[a]
Unidimensional			
Pain visual analogue scale (VAS) (intensity)	53	21	[36]
Pain numerical rating scale (NRS) (intensity)	9	2	[37]
Pain intensity categories (mild, moderate, severe)	16	7	[35]
Pain improvement/relief categories[b]	5	1	[38]
Pain pattern (constant/intermittent)	12	2	[34]
Postprandial pain (yes/no or intensity)	5	3	[32]
Frequency of pain attacks[c]	10	4	[39]
Bidimensional			
(Number of days with pain) x (median pain VAS)	1	1	[40]
(Daily pain duration) x (median pain VAS)	1	1	[41]
(Number of hours of pain) x (median pain VAS)	1	1	[42]
(Degree of frequency) x (median pain VAS)	1	0	[43]
(Pain frequency) x (Pain severity)	1	0	[44]
Multidimensional			
McGill Pain Questionaire (full and short-form)	5	3	[37]
PainDetect Questionaire (PDQ)	1	1	[18]
Pain score (intensity, frequency and consequences of pain)[d]	1	0	[45]
Impact of pain			
Quality of life (QOL) scales (EORTC, EuroQol, SF-36/SF-12)[e]	19	5	[20, 46, 47]
Brief Pain Inventory (BPI)	2	1	[18]
Pain Disability Index (PDI)	2	1	[19]
Pain Coping and Cognition List (PCCL) Questionaire	1	0	[20]

[a] Reference in which the pain assessment tool was first used pre- and post-intervention in chronic pancreatitis.
[b] Pain improvement/relief categories: Complete/partial/none; none/transient/moderate/asymptomatic; worse/unchanged/improved; complete/major/absence; relief/considerable/improvement.
[c] Frequency assessed as: none/daily/weekly/monthly/yearly; painful days per month; pain attacks per year; occasional/frequent/daily/severe.
[d] Intensity, frequency and consequences of pain are individually graded on a 0–8 scale and the sum of the scores determine final pain score: mild pain (score of 1–8) moderate pain (score of 9–14); severe pain (score of 15–24).
[e] European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC-QLQ-C30); EuroQol questionaire; Medical Outcomes Study Short Form-36 Health Survey (SF-36) and Short Form-12 Health Survey (SF-12).

review highlights that there are no published pain assessment tools that include all recommended aspects of pain (AGA reference) and others not recommended. There would appear to be significant scope to improve pain assessment in CP with benefits for clinical care and research, including treatment selection and efficacy.

The need for improved tools for pain assessment is widely recognized. The Italian [3], Belgian [2] and PancreasFest [4] guidelines all indicated the lack of specific validated tools for evaluating pain in CP. The criteria proposed by AGA for assessing pain in CP [14] and the 8 additional aspects of pain added from the literature [4,18–20] have been compared with recommendations by international consensus guidelines [2–4,15] in Table 5. This clearly shows that current pain assessment tools are limited in scope and inadequate and this is particularly so for CP-specific pain assessment tools including Izbicki pain score, Ammann tool and Pancreas Quality of Life Instrument (PANQOLI). The PancreasFest guidelines recommend the assessment of psychological co-morbidities and functional pain using validated instruments like the Pain Anxiety Symptom Scale (PASS), the Pain Catastrophizing Scale (PCS), the Drug Abuse Screening Test (DAST), the brief Michigan Alcohol Screening Test (bMAST), and the Current Opioid Misuse Measure (COMM). To assess treatment response to interventions over time, the PancreasFest guidelines also recommend using objective measures like serial validated pain scores, QOL

Table 3
Specific pain assessment tools used in included clinical studies of patients with chronic pancreatitis. These tools were developed specifically for chronic pancreatitis.

Specific pain assessment tools	Number of studies	Number of RCT	Reference[a]
Izbicki pain score[b]	13	5	48
Ammann (Type A & B)[c]	5	0	49
Type A-E[d]	1	1	50
Group 1–3 pain patterns[e]	1	0	51
QLQ-PAN28[f]	2	1	28

[a] Reference in which the pain assessment tool was first developed specifically for patients with chronic pancreatitis.
[b] Pain score comprising of pain visual analogue scale (VAS), frequency of pain attacks, analgesic medication and duration of disease-related inability to work.
[c] Type A pain pattern (Intermittent) typically observed in acute relapsing pancreatitis, is short-lived pain episodes usually lasting <10 days and separated by long pain-free intervals of several months to >1 year. Type B pain (Constant) is characterized by prolonged periods of persistent (daily) pain and/or clusters of recurrent severe pain exacerbations. Typically severe pain occurred for 2 or more days per week for at least 2 months. May follow A type pain episode.
[d] Type A: Episodes of mild to moderate pain, usually controlled by medication; Type B: Constant mild to moderate pain usually controlled by medication; Type C: Usually pain free with episodes of severe pain; Type D: Constant mild pain plus episodes of severe pain; Type E: Constant severe pain that does not change.
[e] Group 1: constant pain; Group 2: Constant pain with acute exacerbations; Group 3: Only acute exacerbations and no constant pain.
[f] Quality of Life Questionnaire-Pancreas Modification (QLQ-PAN28) to be used together with European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30).

Table 4
Aspects of pain included in general multidimensional tools, specific pain assessment tools for chronic pancreatitis (CP), and impact of pain assessment tools (adapted from the criteria for evaluation of pain by the American Gastroenterological Association [14] with 8 additional pain aspects from the literature [4,18–20]).

Aspects of Pain	General multidimensional tools		CP-specific tools				Impact of pain tools			
	MPQ[a]	PDQ[b]	Izbicki[c]	Amman	Type A-E	Group 1-3	BPI[d]	PDI	PCCL	QOL scales
Key reference	[37]	[18]	[48]	[49]	[50]	[51]	[18]	[19]	[19]	[20,28,46,47]
Duration of pain										
Location of pain		■					■			
Radiation of pain		■								
Triggers/exacerbators of pain	F	■								
Pain pattern (Continuous/Intermittent)	F	■		■	■	■				
Objective measure of pain intensity[e]	S	■	■				■			
Subjective estimate of intensity of pain[f]	F				■	■				■
Frequency of pain attacks			■	■						
Description of pain	B	■								
Associated symptoms with pain	B	■								
Postprandial pain										
Analgesic use			■				■			
Relieving factors of pain	F						■			
Ability to work/occupation status			■				■	■		■
Effect on daily activities/function							■	■	■	■
Effect on mental health							■		■	■

PDI: Pain disability index; PCCL: Pain coping and cognition list; QOL: Quality of life scales (European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC-QLQ-C30) and Quality of Life Questionnaire-Pancreas Modification (QLQ-PAN28); EuroQol questionaire; Medical Outcomes Study Short Form-36 Health Survey (SF-36) and Short Form-12 Health Survey (SF-12).
Shaded boxes indicate aspects of pain that were included in the corresponding pain assessment tool used in pain evaluation in chronic pancreatitis.
[a] McGill pain questionnaire (MPQ) refers to full McGill (F), short-form McGill (S) and both (B).
[b] PainDetect Questionnaire (PDQ) uses pain Numerial Rating Scale (NRS) for assessment of pain intensity.
[c] Izbicki uses pain Visual Analogue Scale (VAS) for assessment of pain intensity.
[d] Brief Pain Inventory (BPI) uses pain NRS for assessment of pain intensity.
[e] Pain VAS, NRS or descriptor.
[f] Mild, moderate or severe.

Table 5
Criteria for the evaluation of pain in chronic pancreatitis as proposed by the American Gastroenterological Association (AGA) [14] and 8 additional aspects of pain from the literature [4,18–20], compared with recommendations from international consensus guidelines [2–4,15].

		International consensus guidelines recommendations for pain evaluation			
		Italian	German, Swiss and Austrian	Belgian	PancreasFest
Evaluation of pain proposed by AGA	Duration of pain dating back to the first episode				
	Character of pain: intermittent vs. daily; frequency if intermittent	■	■	■	■
	Subjective estimation of intensity of pain: mild, moderate, or severe				
	Objective measurement of pain: visual analogue or descriptor (e.g.,1–5; 1–10)		■	■	■
	Use of narcotics and other medications to treat pain		■	■	■
	Evaluation of addiction to narcotics				
	Documentation that other diseases have been excluded that could be causing abdominal pain				
	Measurement of quality of life including work performance, social interaction, and family interaction	■	■	■	■
Eight additional aspects of pain from the literature	Location of pain				
	Radiation of pain				
	Triggers/exacerbators of pain				
	Description of pain				■
	Associated symptoms of pain				
	Postprandial pain				
	Relieving factors of pain				
	Effect on mental health	■	■	■	■

Shaded boxes indicate aspects of pain that were included in the corresponding international consensus guidelines for pain evaluation in chronic pancreatitis.

instruments, pain medication use, frequency of pain episodes, hospitalizations and emergency room visits [4]. These recommendations highlight the absence of standardised criteria for pain assessment in CP among international experts and the urgent need for a comprehensive and validated pain assessment tool specific for CP.

These international consensus guidelines [2–4,14,15] (Tables 5 and 6) clearly state that the evaluation of pain duration, patterns, intensity, character, frequency, narcotic use and QOL are all important for appropriate pain assessment and management in CP. From the present literature review, none of the current pain assessment tools covered all these aspects of pain. This is especially apparent in the CP-specific pain assessment tools, where only 2–4 aspects of pain are covered. Of the studies that reported CP-specific tools, almost two thirds used the Izbicki pain score, and it has been recommended by the German, Austrian and Swiss and Belgian consensus guidelines for pain evaluation [2,15]. But the Izbicki pain score only covers 4 aspects of pain and has not had psychometric validation. The general pain assessment tools MPQ, PDQ and BPI cover 7 aspects of pain, which make them more comprehensive tools for pain assessment than the CP-specific tools. In addition to pancreatic pain, patients with CP are more likely to have other pains not directly related to CP, such as neuropathic and central sensitisation components [52] and it is not known whether current pain assessment tools are able to distinguish pancreatic from non-pancreatic pain.

Surprisingly there were two aspects of pain that were not included in any pain assessment tool. The duration of pain in CP was considered important in a recent systematic review that reported early surgery in CP leads to significantly higher likelihood of postoperative pain relief [30]. Following which, a retrospective study by the same group found that surgical intervention before

Table 6
Pain assessment tools recommended for pain evaluation in chronic pancreatitis by international consensus guidelines [2–4,15].

Guidelines	Pain assessment tools recommended							
	Pain VAS	Ammann	Izbicki pain score	MPQ	PROMIS	SF-12	EORTC QLQ-C30	PANQOL
Italian		EL 2b; RG B				EL 1b; RG B	EL 1b; RG B	
German, Swiss and Austrian	EL 1b; RG B		EL 1b; RG B				EL 1b; RG B	
Belgian	■		■			■		
PancreasFest	EL 2b; RG C			EL 2b; RG C	EL 2b; RG C	EL 2b; RG C		EL 2b; RG C

VAS = Visual analogue score.
MPQ = McGill Pain Questionnaire.
PROMIS = NIH Patient-Reported Outcome Measurement Information System.
SF-12 = Medical Outcomes Study Short Form −12 Health Survey.
EORTC = European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire.
PANQOL = Pancreas Quality of Life Instrument.
Based on Oxford Centre for Evidence-Based Medicine: EL = Evidence level; RG = Grades of Recommendation.
Shaded boxes indicate the pain assessment tools that were recommended by each individual international consensus guidelines for pain evaluation in chronic pancreatitis.

26.5 months of CP diagnosis was predictive of pain relief and less narcotic use postoperatively [29]. To be clear, the duration of pain is important as a baseline pain assessment for selection of appropriate treatment and is less useful as a follow up assessment of outcomes post intervention. A second overlooked aspect of pain is the postprandial exacerbation, or what is sometimes called 'obstructive' type pain. It is considered important by clinicians, not only because it is responsible for eating avoidance and weight loss, but because it might also reflect subgroup of patients that might benefit from duct decompression. Trial endoscopic stenting has been used to successfully treat postprandial pain exacerbations (but not chronic unremitting pain) in CP [32,34] and in malignancy [53] as well as to predict those in whom surgical decompression might be effective in CP [54,55]. However, an algorithm designed to predict a favourable response to surgical treatment did not include post-prandial pain as a predictor [56].

The current general pain assessment tools have not been validated for use in CP, except the SF-36 and SF-12, which were found to be a reliable and valid measure of QOL in CP [24–26]. Of the CP-specific pain assessment tools, the EORTC QLQ-C30 with QLQ-PAN28 had formal psychometric evaluation, which showed that it was appropriate for CP [28]. Another CP-specific QOL-only measurement tool, the PANQOLI, had recent psychometric evaluation showing excellent reliability and construct validity, correlating well to the EORTC QLQ-C30 with QLQ-PAN26 and SF-12 [57,58]. However, these tools only measure QOL and do not assess other aspects of pain. Hence, they cannot be used in isolation for pain evaluation.

Due to the large number of aspects of pain found in the literature, they were categorised into the following groups: 1) directly related to pain (duration of pain, location of pain, radiation of pain, triggers/exacerbators of pain, pain pattern, intensity of pain, frequency of pain attacks, description of pain, associated symptoms of pain, postprandial pain, analgesic use and relieving factors); 2) psychological aspects (effect on mental health); 3) associated with quality of life (ability to work/occupation status and effect on daily activities/function). These groups will provide a foundation for developing a pain assessment tool that is appropriate for chronic pancreatitis.

Besides the aspects of pain discussed above, the feasibility of neuroimaging for pain assessment in CP has been investigated. Magnetic Resonance imaging (MRI) studies of the brain found that pain in CP is associated with reorganisation of the insular cortex [59]; microstructural changes in the brain could be correlated with clinical pain scores and pain patterns (intermittent or constant) in patients with CP [60]; and cortical thickness was reduced and correlated with pain scores in specific areas of the brain in CP patients [61]. These studies suggest that the pain experience in CP results in brain changes that can be detected with imaging. With more research, perhaps neuroimaging in CP may enable better understanding of the pain mechanisms at work in the brain and contribute to the overall clinical picture that will influence selection of treatments.

This systematic review has several limitations. The search strategy was limited to studies that evaluated interventions for pain in CP and did not include observational studies of pain in CP, which might provide more information on pain assessment tools from the longitudinal data. However, the few longitudinal observational studies that monitored the natural history of CP did so in the context of multiple interventions for pain over time [62–65]. This review did however include some studies with follow up periods of over 10 years, making them longitudinal studies in their own right [36,66–69]. Only English speaking articles were chosen for this review.

This review has highlighted that the current pain assessment tools are of limited scope, are not well validated and have generally been used to determine intervention efficacy using suboptimal experimental design, with only a quarter of the intervention studies were RCTs. Advances in the treatment of pain in CP requires pain assessment tools that incorporate all important aspects of pain. Therefore, there is a need to develop a more comprehensive and better validated pain assessment tool for patients with CP. This tool has the potential to help standardise pain assessment in CP, enable the accurate monitoring of clinical course and predicting outcome in individual patients, provide new insights into the relationship between aspects of pain and underlying pain mechanisms, help to select appropriate treatments (combination and sequence), report the response to various interventions for pain, facilitate clinical communication and to improve the allocation of patients into groups for clinical trials. The recommendations from guidelines for the assessment of pain in CP provide a sound basis for the development of a more comprehensive pain assessment tool (see Tables 4–6) by integrating the different aspects of pain.

At this point, evidence for which aspects of pain is most crucial for CP is lacking. Therefore, a validation of a comprehensive pain assessment tool would require an expert review and prospective evaluation of patients with CP and in response to treatments – with the goal to discriminate aspects of pain that are essential for pain assessment in CP. This effort has been started at our institution with several international collaborations. Ultimately a new comprehensive pain assessment tool will need to be tested by comparison with current pain assessment tools to determine whether the potential advantages are realised and how they can be further improved. An improved approach to pain assessment has the potential to identify different pain mechanisms in patients and to improve selection for different interventions. Realising these goals for clinical pain assessment and the improvement of the tools themselves will be helped by identifying accurate biomarkers that reflect critical pathophysiology and pain mechanisms.

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