Published in final edited form as:

Psychosomatics. 2017 ; 58(3): 252–265. doi:10.1016/j.psych.2016.12.003.

Non-cardiac Chest Pain: A Review for the Consultation-Liaison Psychiatrist

Kirsti A. Campbell, B.S., Elizabeth N. Madva, M.D., Ana C. Villegas, M.D., Eleanor E. Beale, B.A., Scott R. Beach, M.D., Jason H. Wasfy, M.D., M.Phil., Ariana M. Albanese, B.A., and Jeff C. Huffman, M.D.

Harvard Medical School (KAC, ENM, SRB, JHW, JCH), Boston, MA; Department of Psychiatry (KAC, ENM, ACV, EEB, SRB, AMA, JCH) and Division of Cardiology, Department of Medicine (JHW), Massachusetts General Hospital, Boston, MA

Abstract

Background—Patients presenting with chest pain to general practice or emergency providers represent a unique challenge, as the differential is broad and varies widely in acuity. Importantly, most cases of chest pain in both acute and general practice settings are ultimately found to be non-cardiac in origin, and a substantial proportion of patients experiencing non-cardiac chest pain (NCCP) suffer significant disability. In light of emerging evidence that mental health providers can serve a key role in the care of patients with NCCP, knowledge of the differential diagnosis, psychiatric co-morbidities, and therapeutic techniques for NCCP would be of great use to both consultation-liaison (C-L) psychiatrists and other mental health providers.

Methods—We reviewed prior published work on (1) the appropriate medical workup of the acute presentation of chest pain, (2) the relevant medical and psychiatric differential diagnosis for chest pain determined to be non-cardiac in origin, (3) the management of related conditions in psychosomatic medicine, and (4) management strategies for patients with NCCP.

Results—We identified key differential diagnostic and therapeutic considerations for psychosomatic medicine providers in 3 different clinical contexts: acute care in the emergency department, inpatient C-L psychiatry, and outpatient C-L psychiatry. We also identified several gaps in the literature surrounding the short-term and long-term management of NCCP in patients with psychiatric etiologies or co-morbid psychiatric conditions.

Conclusions—Though some approaches to the care of patients with NCCP have been developed, more work is needed to determine the most effective management techniques for this unique and high-morbidity population.

Keywords

non-cardiac chest pain; consultation psychiatry; psychosomatic medicine; cardiac; disease management

Send correspondence and reprint requests to: Jeff C. Huffman, MD, Department of Psychiatry, Massachusetts General Hospital, Blake 11, 55 Fruit Street, Boston, MA 02114; jhuffman@partners.org.

Disclosure

The authors disclosed no proprietary or commercial interest in any product mentioned or concept discussed in this article.

INTRODUCTION

Chest pain is the presenting complaint of more than 7 million emergency department (ED) visits¹ and as many as 27 million office visits^{1,2} in the United States each year. The differential diagnosis of chest pain is broad, and the initial workup is focused on excluding acute, life-threatening etiologies such as acute coronary syndrome (ACS) or pneumothorax. Though the proportion of ED visits resulting in an ACS diagnosis has decreased by 45% over the past decade, chest pain is triaged as requiring urgent or emergent evaluation 2–3 times more frequently than other symptoms.³ Many patients in ED³ and primary care settings^{2,4} have a negative cardiac workup, but continue to have symptoms.

This recurring chest pain of non-cardiac origin, termed “non-cardiac chest pain” (NCCP), represents a significant burden to providers across clinical settings. More than 50% of all cases of chest pain presenting to the ED³ and more than 80% of cases in primary care settings⁵ appear to be secondary to NCCP. The lifetime prevalence of NCCP is estimated to be as high as 33%.⁶ Furthermore, the broad differential diagnosis for chest pain and the potentially fatal consequences of missing an acutely life-threatening medical condition add complexity to clinical decision-making. Though the total financial burden of NCCP is difficult to assess, the cost may be as much as or greater than the cost for patients with an ACS.⁷ There are 2 million hospital admissions annually for chest pain in the United States, costing up to \$8 billion,^{8–10} and three-fourths of admissions with an initial diagnosis of myocardial ischemia are shown to be incorrect.¹¹

Quality of life (QOL) in patients with NCCP is diminished when compared with healthy controls (e.g., as measured by the SF-36 Health-Related Quality of Life [HR-QoL] questionnaire) and, notably, is as low as in patients with coronary artery disease (CAD).¹² Several factors contribute to this low QOL, including social withdrawal, avoidance of activities that can elicit or exacerbate symptomatology, and the presence of co-morbid psychiatric conditions such as anxiety and depression. Many patients with NCCP also seek further cardiac assessment, despite diagnostic reassurance.¹³ Work performance is commonly affected: patients with NCCP take substantial time away from work and often become unemployed.¹⁴ Though no studies specifically investigate the cost of evaluating NCCP in Quality-Adjusted-Life-years, we can perhaps extrapolate from studies evaluating the cost effectiveness of diagnostics for chest pain in general. As an example, a study evaluating the cost effectiveness of inpatient telemetry found that it is only “cost effective” when patients have a risk of ACS greater than 3%.¹⁵ Further work is needed to elucidate the costs of NCCP, including costs from direct health care spending and lost productivity.

In some cases, NCCP could be considered a functional cardiac or gastrointestinal illness, characterized by symptoms without clear physiologic underpinnings or enzymatic, imaging, stress test, or anatomic confirmation of pathophysiologic processes.¹⁶ Although the literature surrounding functional gastrointestinal disorders (FGID) has advanced in the past decade with improved diagnostic and therapeutic techniques,¹⁷ recommendations for patients with functional chest pain are often focused solely on excluding CAD. Integrated care with a biopsychosocial approach may provide a feasible, cost-effective method for

treating patients with NCCP,^{18–20} but specific recommendations for providers regarding best practices for evaluation, intervention, and referral are limited.

In this review, we focus on diagnostic and therapeutic considerations in patients with NCCP relevant to the consultation-liaison (C-L) psychiatrist, both in the outpatient and inpatient setting. We additionally discuss recommendations for appropriate care drawing from the current literature on NCCP, which draws from literature in both internal medicine and psychiatry, and on functional gastrointestinal and neurological disorders, which has primarily been published in the gastroenterology and neurology literature. Though most patients with NCCP will first present to a primary care provider or ED physician, it is increasingly clear that mental health providers are a necessary part of the treatment team for many NCCP etiologies.

OVERVIEW OF NCCP

Initial Evaluation of Chest Pain

Evaluation of the patient presenting with chest pain to the ED focuses primarily on hemodynamic stabilization and exclusion of an acute life-threatening process. Accordingly, any patient with unstable vital signs will immediately undergo assessment of airway, breathing, and circulatory function with diagnostic evaluation (e.g., electrocardiogram [ECG], chest x-ray, and bedside echocardiogram) guided by the patient's clinical presentation (hemodynamic stability, shortness of breath, diaphoresis, and localization of pain) for identification of acute life-threatening conditions such as ACS, pneumothorax, cardiac tamponade, aortic dissection, acute heart failure, esophageal rupture, or pulmonary embolism. In hemodynamically stable patients, common workup in addition to a detailed history and examination includes a 12-lead-ECG, a complete blood count, and cardiac enzymes, along with chest x-ray if clinical suspicion dictates or other workup has been negative. Importantly, premature closure of the differential diagnosis may be particularly harmful in patients with an underlying psychiatric co-morbidity, as there is a well-known higher burden of serious medical problems, including cardiovascular disease in patients with mental illness.²¹

In the outpatient setting, a detailed history and physical examination are important for determining the need for further referral or diagnostic testing. Symptoms suggestive of a possible acute ischemic process (e.g., escalating chest pain, typical angina, and diaphoresis)²² or unstable vital signs warrant emergent referral. Otherwise, an ECG is typically reserved for new-onset or evolving chest pain without a more obvious cause (e.g., pneumonia and traumatic chest wall injury), with potential referral to more acute settings based on findings.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis for chest pain involves multiple organ systems and varies widely in severity. The Table displays the common basic differential diagnosis for patients presenting with chest pain, and clinical considerations for each organ system are detailed later.

Cardiac Causes of Chest Pain

Cardiac causes of chest pain can include myocarditis, pericarditis, acute heart failure, aortic dissection, exertional angina, and ACS. Unfortunately, both the physical examination and detailed history are frequently insufficient to rule out an acute cardiac process, though are useful in suggesting specific etiologies, such as back pain of tearing quality raising concern for aortic dissection or chest pain improved by leaning forward suggesting pericarditis.

Integrating the patient's history, physical examination, and diagnostic studies becomes critically important in identifying both the patients at highest risk of acute cardiac processes and those at risk of undergoing unnecessary repeated cardiac workups. Potential indications for need to avoid further cardiac diagnostic testing include residual pain after multiple negative investigations or reassuring recent coronary angiogram.²³ Notably, there are no established guidelines for sufficient exoneration of cardiac causes of persistent chest pain, but periodic future investigations in patients who have had previously negative workups are warranted, as some may come to develop underlying cardiac disease.

Gastrointestinal Causes of Chest Pain

Gastrointestinal etiologies, particularly gastroesophageal reflux disease (GERD), account for a substantial proportion of NCCP, and often manifest with typical angina symptoms, including squeezing or burning substernal discomfort.²⁴ A small number of cases can be caused by ulcerative disease or esophageal motility disorders. Esophageal hypersensitivity,²⁵ which may be owing to abnormal visceral proprioception exacerbated by multiple factors including psychological stress, represents a potential functional etiology.²⁴

Pulmonary Causes of Chest Pain

Several pulmonary pathologies, including those of vascular, parenchymal, and pleural origin, can present with chest pain. Both symptoms (e.g., subjectively reported dyspnea and cough) and physical signs (e.g., tachypnea, wheezing, localized crackles on examination, and low oxygen saturation) can be useful in suggesting a pulmonary etiology.

Musculoskeletal Causes

Musculoskeletal etiologies of chest pain, including costochondritis and traumatic injury, may account for nearly half of all non-emergent cases of chest pain.²⁶ Physical examination findings, such as reproducibility on palpation, can be useful in suggesting a musculoskeletal cause. Plausible traumatic injury in the medical history is also suggestive of musculoskeletal pathology.

THE PSYCHIATRIC DIFFERENTIAL DIAGNOSIS

Appropriate recognition of underlying psychiatric disorders—either those directly causing the experience of chest pain or those contributing to distress in combination with other factors—can be of great value. Establishing the relative contribution of psychiatric pathology to NCCP cases is difficult, as psychiatric contributors are usually treated as diagnoses of exclusion. For example, a patient may develop a thoracic hyperventilatory breathing pattern precipitated or exacerbated by psychologic arousal, leading to

musculoskeletal chest pain.²⁷ A thorough psychiatric differential diagnosis should include panic disorder (PD), generalized anxiety disorder (GAD), post-traumatic stress disorder (PTSD), major depressive disorder (MDD), illness anxiety disorder (IAD), and somatic symptom disorder (SSD).

Anxiety Disorders

Although many patients with chest pain of any origin will experience anxiety during the episode, symptoms suggestive of a more chronic underlying anxiety disorder are present in most patients presenting with chest pain in primary care settings and in up to one-third of patients presenting to the ED.²⁸ Importantly, there is likely a bidirectional relationship between chest pain and underlying anxiety disorders. For example, the discomfort and potential implications (e.g., an ACS) of an episode of chest pain may precipitate a panic attack, and the physical manifestations of persistent worry may be anginal in character.

Panic Disorder—PD both contributes to and co-occurs with chest pain: up to 70% of panic attacks feature chest pain as a symptom,^{29,30} and between 25% and 60% of patients with chest pain referred for cardiac investigations have PD,³¹ including 31% of NCCP cases.³² Although PD is independently associated with higher incidence rates of coronary heart disease (CHD) and myocardial infarction, it is unclear whether this represents a bidirectional or causal relationship.³³ A meta-analysis regarding the prevalence of PD among those seeking treatment for chest pain revealed that an atypical quality of chest pain, female sex, younger age, high levels of self-reported anxiety, and the absence of known CAD correlated with higher rates of PD.³⁴ A study of 572 patients presenting to the ED with unexplained chest pain found that 42% of the cohort experienced panic attacks, and within that subset, 45% met criteria for PD.³⁵

Generalized Anxiety Disorder—The prevalence of GAD in patients with NCCP ranges from as low as 5.7% to more than 30%.^{36–38} GAD also frequently co-occurs with PD in patients with NCCP.³⁹ Early studies of psychiatric illness found high rates of “anxiety neurosis,” which included both panic and GAD, in patients with normal coronary angiography.^{39,40} Interestingly, in a study supporting a high prevalence of GAD (more than 30%) in patients with normal angiography, every patient with GAD had concurrent PD.³⁷

Post-traumatic Stress Disorder—Though the prevalence of PTSD in NCCP has not been formally studied, there appears to be a relatively robust relationship between CAD and PTSD. Some studies estimate that up to 16% of patients develop PTSD after (and related to) an ACS.^{41–45} Furthermore, the relationship appears to be reciprocal: evidence also suggests that PTSD may be an independent risk factor for CAD, and there is some prospective evidence of an association between PTSD symptoms and risk of CHD development.^{43,46} The mechanism of this association has yet to be elucidated.

Regarding its possible contributions to the patient population with NCCP, PTSD can involve physical symptoms that mimic an ACS, including shortness of breath, chest tightness, and numbness that are ultimately non-cardiac in origin. This highlights the need for careful and thorough evaluation of patients with chest pain and concern for PTSD, as their chest pain

may represent true CAD (indeed, ACS-induced PTSD may increase risk of ACS⁴⁵) or NCCP related to underlying PTSD. A clue to the diagnosis of PTSD is the predictable occurrence of these symptoms in situations related to the precipitating trauma.

Other Psychiatric Disorders

Major Depressive Disorder—The associations between mood disorders and NCCP are likely complex and bidirectional. Some patients with MDD experience somatic symptoms, which may include subjective worsening of existing medical conditions or the development of new, unexplained physical symptoms such as pain. Additionally, stress caused by chronic chest pain may precipitate depressive episodes and detract from adaptive behaviors that promote psychologic well-being. A systematic review of psychologic outcomes in patients with NCCP presenting to the ED concluded that patients with NCCP had similar levels of depressive symptoms to those with a cardiac diagnosis, whereas patients with both cardiac and non-cardiac disease had higher levels of depressive symptoms than healthy controls. The prevalence of depressive symptoms in patients with NCCP in this review ranged from 9–40%.⁴⁷

SSD and Related Disorders—SSD and related disorders encompass a group of illnesses that involve subjective physical symptoms for which there is no obvious medical explanation. Although some patients with SSD present with numerous physical complaints, whereas others may experience a single symptom, such as chest pain, that recurs over time. The hallmark of the disorder involves spending a disproportionate amount of time worrying about or attempting to mitigate physical symptoms. The estimated prevalence of SSD and related disorders in the general population is only 1–3%,⁴⁸ though in certain medical population groups prevalence is estimated to be much higher. For example, in some neurological practices the prevalence is as high as 20–30%,⁴⁸ and a large epidemiological study of chronic pain in the United States found a prevalence of 15%.⁴⁹ Rates of SSD in NCCP have not been formally studied, but anecdotal evidence suggests that SSD accounts for a small but meaningful proportion of patients with NCCP.

Factitious disorder, which is now classified under somatic symptom and related disorders in the DSM-5 and refers to patients who feign symptoms for some primary (i.e., internally motivating) gain such as to achieve the sick role, can also be seen in patients with NCCP. Several extreme NCCP-related case reports exist, including a patient who feigned aortic dissection and underwent thoracotomy, and a patient who induced a recalcitrant supraventricular tachycardia with surreptitious albuterol misuse over several years.^{50,51} In a study of factitious disorder, nearly 5% of cases were referred from cardiology.⁵²

Illness Anxiety Disorder—Although patients with SSD are preoccupied with chest pain as a symptom, patients with IAD are focused on the idea that their symptoms represent an ACS or other serious cardiac illness. Somatic symptoms may be a fairly minimal component of the presentation and are often overshadowed by ruminative worry about having an illness. Although many patients with IAD rotate through a variety of somatic preoccupations affecting multiple organ systems, some will focus on a particular symptom or organ system. At any particular point in their illness, a patient with IAD may be amenable to reassurance

and dutiful clinical attention, though this reassurance often fades quickly, prompting repeated presentations. As with SSD, rates of IAD in NCCP are unknown.

“Cardiophobia” is a subtype of IAD that specifically manifests in response to chest discomfort.^{53,54} It has been described as an unconscious negative interpretation of somatosensory and cardiopulmonary sensations that elicits anxious feelings and leads to avoidance of activities associated with chest discomfort.^{55,56} As with IAD, frequent visits to the doctor often develop as a mechanism of reassurance, and these patients can be reluctant to acknowledge that psychosocial factors might elicit autonomic physical sensations that coincide with their symptoms; such denial can play a major role in the maintenance of this condition.⁵⁷

The Cardiac Anxiety Questionnaire⁵⁸ was designed to evaluate cardiophobia and other heart-focused anxiety and has been used in several studies of patients with and without underlying CAD. In a study of 658 patients either self-referred or physician-referred for further evaluation of CAD, individuals without evidence of coronary artery calcification had higher mean scores on both attention to cardiac symptoms and fear of having these symptoms.⁵⁹ This lends credence to the concept that the uncertainty prompted by not receiving a cardiac diagnosis can exacerbate worry about chest pain and possibly contribute to reductions in QOL.

Deception Syndromes—Though uncommon, deception syndromes, such as malingering, should be considered in patients presenting to physicians repeatedly with the same symptom. Patients may malingering chest pain to receive analgesics, such as opiates, to seek shelter, or to avoid other responsibilities, such as legal obligations. Although malingering can be difficult to confidently diagnose and is likely best considered as a diagnosis of exclusion, it should be considered whenever the symptoms seem incongruent to the patient’s presentation.⁶⁰ It is important to consider deception syndromes in the differential diagnosis of NCCP because chest pain is an easily accessible and well-known medical complaint.

Contributions of Personality

Aspects of personality, including social inhibition and negative affectivity, have been studied as potential factors in cardiovascular well-being and persistent chest pain. In particular, there is some (albeit conflicting) evidence that the “type D” distressed personality type, defined in individuals who simultaneously experience negative emotions and inhibit self-expression, may be linked to NCCP, adverse cardiac outcomes, and impaired self-reported physical and mental health.^{61–64} The TweekSteden Mild Stenosis (TWIST) observational study, as an example, demonstrated an association between type D personality and persistent chest pain.⁶⁵

Evidence surrounding the contributions of the type A behavior pattern (TABP), characterized by a high competitive drive and ambition, as a risk factor for CHD is likewise inconclusive.^{66,67} Further study of possible associations between type A behavior pattern and persistent chest pain is warranted.

INTERVENTIONS TO TREAT NCCP

Several interventions for the treatment of NCCP have been evaluated. Small numbers of participants, short follow-up periods, inconsistency of study design, and few randomized controlled trials (RCTs) were noted as common limitations in a recent Cochrane review of 17 RCTs assessing psychologic interventions for NCCP symptom management.⁶⁸ With so few studies, evaluating psychiatric care for patients with NCCP, more research is needed to determine the most effective methods of intervention.

Cognitive-Behavioral Therapy

The Cochrane review⁶⁸ reported that cognitive-behavioral interventions were most successful in reducing chest pain severity and frequency. Cognitive-behavioral therapy (CBT) appears to be the most effective psychologic treatment for NCCP. By addressing maladaptive cognitions about physical symptoms, CBT can help patients with NCCP to reframe the etiology of their chest pain and to reduce the anxiety accompanying their symptoms. CBT can also be effective in targeting the misinterpretation of minor physical symptoms as a sign of more serious disease.

Several studies have evaluated the efficacy of CBT for NCCP. As an example, Mayou et al.⁶⁹ used a multistage CBT intervention aimed at assessing patients' baseline degree of limitation and beliefs about symptom causation; providing alternative non-cardiac explanations for symptoms; and identifying the role of hyperventilation, muscular tension, catastrophic thoughts, and patient-specific factors in causing or sustaining symptoms. Patients with persistent chest pain for 6 weeks after being reassured by a cardiologist that they had no cardiac disease were randomized into multistage CBT treatment (up to 12 sessions of individual therapy) or an "assessment only" control group (who underwent solely a baseline assessment). Both groups were provided with diaries to record symptoms and asked to follow-up at 3 and 6 months. At the 6-month follow-up, the CBT group showed significant improvement in symptom severity and all measures of social activity (e.g., functional limitation and level of social impairment) when compared with the control group. This study demonstrated that identifying maladaptive cognitions and providing appropriate alternative explanations for symptom causation, in addition to learning behavioral coping techniques, can lead to improvement of function.

Shorter CBT interventions have also been evaluated. Esler et al.⁷⁰ assessed the efficacy of a single 1-hour CBT session in patients presenting to an ED with NCCP. Those in the CBT group had a significant decrease in chest pain frequency and levels of anxiety, but no change in symptom severity, QOL, or psychologic distress, at 1 and 3-month follow-ups compared with the control group who received only routine ED care. Beek et al.⁷¹ found that 6 CBT sessions in ED patients with NCCP and co-morbid PD or depression were effective in reducing symptoms of anxiety and depression.

Hypnosis

According to the Cochrane review of RCTs assessing psychologic interventions for NCCP, hypnotherapy may be an effective alternative to CBT, although only 1 RCT met inclusion

criteria.⁶⁸ Hypnosis focuses on relaxation and concentration as a basis for addressing NCCP symptoms and associated stress or anxiety. In a study of patients with angina-type chest pain and normal coronary angiography, a 17-week hypnosis treatment led to improvement in chest pain for 80% and improvement in QOL for 73% of the treatment group members—results that remained significant after adjustment for age and baseline levels of anxiety.⁷² A related 8-week, group-based, autosuggestive healing treatment also led to improvement in anxiety and QOL, with significant reduction of both symptom severity and frequency in women with NCCP.⁷³ These results suggest that hypnosis and related treatments can be a useful tool for relieving the psychologic burden that accompanies the unexplained nature of NCCP, adding an element of control to the subjective experience of symptoms.

Breathing Training and Guided Physical Activity

A more basic application of relaxation and breathing training has also been shown to improve NCCP symptoms. A 6-week breathing retraining program in participants with hyperventilation and associated functional cardiac symptoms had a significant effect on CO₂ levels, respiratory rate, and cardiac symptoms.⁷⁴ These findings suggest that simple symptom-targeted interventions can help patients understand connections between behaviors (in this case hyperventilation) and chest pain, with beneficial effects.

Pharmacotherapy

Given the broad medical and psychiatric differential diagnosis for NCCP, the success of pharmacologic treatment depends on accurate identification of underlying conditions contributing to the chest pain. Trials of empiric proton pump inhibitors have been recommended for concurrent diagnosis and treatment of GERD in patients with chest pain inconsistent with cardiac disease,^{25,75–78} as GERD is a significant contributor in many cases.⁷⁸ From a psychopharmacological standpoint, a recent meta-analysis of trials evaluating selective serotonin reuptake inhibitors (SSRIs) for the treatment of NCCP concluded that SSRIs were not superior to a placebo in improving symptoms of chest pain, suggesting that psychopharmacology alone is unlikely to be a sufficient management approach for NCCP.⁷⁹ Notably, 3 of 4 studies included in the meta-analysis excluded patients with comorbid psychiatric disease; as a result, this meta-analysis does not speak to the efficacy of SSRIs in patients with NCCP who have comorbid SSRI-responsive psychiatric conditions (e.g., MDD). Although serotonin-norepinephrine reuptake inhibitors have been used for analgesia in pain syndromes such as diabetic peripheral neuropathy,⁸⁰ fibromyalgia,⁸¹ and osteoarthritis,⁸² their application in patients with NCCP has not been thoroughly evaluated.

Care Management Approaches

Systematic and multidisciplinary team-based approach to evaluation and treatment have also been used for NCCP. In the United Kingdom, “rapid access chest pain clinics” were introduced in the early 2000s in an effort to integrate diagnostic care for patients with angina. Marks et al.⁸³ called for exploration of a biopsychosocial treatment approach within the context of these clinics after demonstrating that patients with NCCP had panic-type beliefs and were less likely to understand and accept their illness than those with positive cardiac workups. They piloted a stepped-care biopsychosocial management program in

which patients with NCCP were evaluated by both a cardiologist and clinical psychologist. Their management program, which involved a comprehensive evaluation for gastrointestinal, musculoskeletal, respiratory, and psychiatric symptoms, reassurance with a biopsychosocial formulation of the patient's pain, and appropriate referral to CBT, when indicated, was effective in reducing frequency, severity, functional impact of and concern about symptoms, and frequency of visits to EDs, general practitioners, and cardiologists.¹⁸

This collaborative approach has been tested in other disorders. In FGID, collaboration with clinical psychologists for psychologic evaluation and patient-specific treatment, when initiated by the primary gastroenterologist, has reduced health care use.⁸⁴ Importantly, this model is distinct from simple reflexive external referral to a mental health clinician; however, recommendations in both neurology⁸⁵ and gastroenterology¹⁷ have emphasized the key role of the medical specialist (in this case, the cardiologist) in collaborating with the mental health provider to validate the patient's symptoms and emphasizing the legitimacy and effectiveness of psychiatric interventions. Guidelines regarding patients with concurrent psychosocial risk factors and CHD have likewise suggested multimodal behavioral interventions.⁸⁶

Clinical Recommendations

Diagnostic Delivery for the Clinician: Lessons Learned From Other Conditions

—After a comprehensive assessment for medical and psychiatric causes of chest pain, if it appears that a patient has a psychosomatic disorder (e.g., SSD), it is vital for clinicians to address this with the patient. Such discussions can be challenging to navigate in the face of patients' beliefs about (and likely investment in) the systemic medical etiology of their illness, but if done well, can lead to acceptance of effective treatment strategies.

Research on the management of functional disorders in gastroenterology and neurology has yielded useful lessons for the providers delivering a diagnosis of NCCP. Attentiveness to diagnostic labels can play a significant role in building a therapeutic relationship. In a study calculating the “number of patients needed to offend” associated with several diagnostic terms providers could apply to symptomatic weakness, researchers found that “medically unexplained weakness” was substantially more offensive to patients than “functional weakness,” despite frequent use of both terms by providers.⁸⁷ A similar study in healthy adults indicated that the terms “persistent physical symptoms” and “functional symptoms” were preferred to “medically unexplained symptoms” or “complex physical symptoms.”⁸⁸

Likewise, it is not just the wording of the diagnosis but also the overall approach that is important when discussing symptoms with patients with NCCP who appear to have somatic symptom and related disorders. Management guidelines for FGID note that empathic acknowledgment of patients' concerns can reduce symptom severity⁸⁹ and involving the patient in the therapeutic plan can improve adherence.¹⁷ In a similar manner, clinical guidelines for the management of functional neurologic symptoms have called for clearly validating the patient's experience, explaining what disorders they do not have, and emphasizing self-help as a key part of getting better.⁸⁵ Additionally, there is some evidence that illness representations, including the patient's understanding of illness chronicity, personal control over symptoms, and possible risks of their condition, are associated with

baseline psychologic distress and lower baseline QOL in patients with NCCP.⁹⁰ Careful exploration of patients' beliefs about their condition could yield clinically useful information regarding need for further psychiatric intervention.

Though these approaches have primarily been used in patients with somatic symptom and other related disorders, they can also be effective in patients with other psychiatric conditions, or those for whom an etiology is entirely unclear. Using well-accepted and non-pejorative terms, acknowledging worry and distress about the source of the symptoms, and clearly acknowledging that the patient's experience is real, will all improve alliance, reduce resistance, and potentially allow greater acceptance of both pharmacologic and non-pharmacologic treatments.

Overall Approach to Treatment

When C-L psychiatrists are called to assist in the care of patients with NCCP, the first step, as described earlier, is establishing an empathic and therapeutic relationship, using appropriate diagnostic labels, and emphasizing the validity of the symptoms experienced, despite a negative cardiac work-up. Second, when NCCP is suspected, careful and broad psychiatric diagnostic assessment should be completed; however, if comorbid psychiatric conditions (such as MDD, PD, or GAD) are identified, the psychiatrist should clarify the extent to which the chest pain can be attributed to the psychiatric condition and provide suggestions for treatment to reduce distress and improve general function. Though many structured assessments of characteristics associated with underlying conditions that cause NCCP exist (such as the Toronto Alexithymia Scale or the Pain Catastrophizing Questionnaire), the use of these scales (outside of standard assessment tools for MDD, GAD, PD, and PTSD) is not diagnostic, and its utility in monitoring response to therapy in NCCP has not been shown. Targeted management of diagnosed primary psychiatric disorders is vital to improve overall outcomes and reduce their potential contribution to ongoing symptoms. This includes pharmacotherapy (e.g., SSRIs for MDD, PD, GAD, and PTSD), or the implementation of regularly scheduled visits with an identified medical practitioner, with careful assessment and physical examination (but no invasive testing unless objective abnormalities are identified) for patients with SSD or IAD.

Third, regardless of the presence of comorbid psychiatric illness, CBT has established efficacy in reducing the severity and frequency of chest pain in NCCP, and can be considered if a referral source is available; moreover, hypnosis and structured breathing exercises may also be considered. Finally, as suggested by the literature in both functional neurologic and gastrointestinal disorders, as well as early studies within the field of NCCP, ongoing interspecialty collaboration can improve patient care. No matter the modality of treatment outlined earlier, any approach that facilitates longitudinal collaboration among providers (e.g., colocation of psychiatric and medical providers for a given NCCP patient, or collaborative care-type models⁹¹) is likely to have the greatest success.

Future Directions

A substantial challenge in the evaluation and treatment of patients with NCCP is the lack of clear diagnostic criteria. At present, NCCP has been defined, with some variation, as

“recurrent chest pain that is indistinguishable from ischemic heart pain after a reasonable workup has excluded a cardiac cause.”²⁴ Although questionnaires^{92,93} aimed at differentiating subtypes of chest pain have been developed, the current definition of NCCP leaves open to interpretation what constitutes a reasonable workup and appropriate diagnostic criteria for NCCP for the definition of FGID. The ROME criteria conceptualize FGID as disorders of “gut-brain interaction” and use a destigmatizing biopsychosocial perspective to divide functional gastrointestinal symptoms into 8 categories (e.g., esophageal and gastroduodenal) with definitions based on the presence, rather than absence, of symptoms, much such as the DSM-5.⁹⁴ Since their introduction in the 1980s, they have fostered more widespread recognition of and research into the pathophysiology and treatment of functional gastrointestinal conditions.¹⁷ The development of specific criteria for NCCP would likewise further advance understanding of NCCP and our ability to accurately diagnose and treat it Appendix 1.

Finally, regarding the optimal management of NCCP from a population health standpoint, an integrated care model may be best suited to coordinate the complex diagnostic and therapeutic management of NCCP. It is clear that cardiologists and primary care providers must play a key role by assessing physical complaints in an ongoing manner, validating symptoms, and communicating the success of psychiatric therapies for the treatment of NCCP, whereas practitioners of psychosomatic medicine and other mental health providers can provide accurate psychiatric assessment and treatment. A model similar to that of Chambers et al.,¹⁸ involving a shared assessment by a cardiologist and C-L psychiatrist and delivery of a biopsychosocial formulation, is one such approach. Given that existing effective approaches for NCCP and promising future collaborative care models all involve integration of cardiac and psychiatric expertise, psychosomatic medicine providers are uniquely positioned to be leaders in the development of improved care for this high-utilizing, high-morbidity population.

Acknowledgments

FUNDING

This work was supported by the National Institutes of Health, United States—National Heart, Lung, and Blood Institute (Grant no. R01HL113272).

References

1. National Center for Health Statistics. National Ambulatory Medical Care Survey: 2010 Summary Tables. 2012. 2014
2. Frese T, Mahlmeister J, Heitzer M, Sandholzer H. Chest pain in general practice: frequency, management, and results of encounter. *J Family Med Prim Care*. 2016; 5:61. [PubMed: 27453845]
3. Bhuiya FA, Pitts SR, McCaig LF. Emergency department visits for chest pain and abdominal pain: United States, 1999–2008. *NCHS Data Brief*. 2010; 43:1–8.
4. Haasenritter J, Biroga T, Keunecke C, et al. Causes of chest pain in primary care—a systematic review and meta-analysis. *Croat Med J*. 2015; 56:422–430. [PubMed: 26526879]
5. Ebell MH. Evaluation of chest pain in primary care patients. *Am Fam Physician*. 2011; 83:603–605. [PubMed: 21391528]
6. Eslick GD, Coulshed DS, Talley NJ. Review article: the burden of illness of non-cardiac chest pain. *Aliment Pharmacol Ther*. 2002; 16:1217–1223. [PubMed: 12144570]

7. Mourad G, Alwin J, Strömberg A, Jaarsma T. Societal costs of non-cardiac chest pain compared with ischemic heart disease—a longitudinal study. *BMC Health Serv Res.* 2013; 13:1. [PubMed: 23286781]
8. Hutter AM Jr, Amsterdam EA, Jaffe AS. 31st Bethesda Conference. Emergency Cardiac Care. Task force 2: Acute coronary syndromes: Section 2B—Chest discomfort evaluation in the hospital. *J Am Coll Cardiol.* 2000; 35:853–862. [PubMed: 10732881]
9. Kahn SE. The challenge of evaluating the patient with chest pain. *Arch Pathol Lab Med.* 2000; 124:1418–1419. [PubMed: 11035567]
10. Pozen MW, D'Agostino RB, Selker HP, Sytkowski PA, Hood WB. A predictive instrument to improve coronary-care-unit admission practices in acute ischemic heart disease. A prospective multicenter clinical trial. *N Engl J Med.* 1984; 310:1273–1278. [PubMed: 6371525]
11. Karlson BW, Herlitz J, Wiklund O, Richter A, Hjalmarson A. Early prediction of acute myocardial infarction from clinical history, examination and electrocardiogram in the emergency room. *Am J Cardiol.* 1991; 68:171–175. [PubMed: 2063777]
12. Ortiz-Garrido O, Ortiz-Olvera NX, Gonzalez-Martinez M, et al. Clinical assessment and health-related quality of life in patients with non-cardiac chest pain. *Rev Gastroenterol Mex.* 2015; 80:121–129. [PubMed: 26148745]
13. Shelby RA, Somers TJ, Keefe FJ, et al. Pain catastrophizing in patients with noncardiac chest pain: relationships with pain, anxiety, and disability. *Psychosom Med.* 2009; 71:861–868. [PubMed: 19737857]
14. Chambers JB, Marks E, Knisley L, Hunter M. Non-cardiac chest pain: time to extend the rapid access chest pain clinic? *Int J Clin Pract.* 2013; 67:303–306. [PubMed: 23279648]
15. Ward MJ, Eckman MH, Schauer DP, Raja AS, Collins S. Cost-effectiveness of telemetry for hospitalized patients with low-risk chest pain. *Acad Emerg Med.* 2011; 18:279–286. [PubMed: 21401791]
16. Aronowitz, R. *Making Sense of Illness: Science, Society, and Disease.* New York: Cambridge University Press; 1998.
17. Drossman DA, Dumitrascu DL. Rome III: new standard for functional gastrointestinal disorders. *J Gastrointest Liver Dis.* 2006; 15:237–241. [PubMed: 17013448]
18. Chambers JB, Marks EM, Russell V, Hunter MS. A multidisciplinary, biopsychosocial treatment for non-cardiac chest pain. *Int J Clin Pract.* 2015; 69:922–927. [PubMed: 25363358]
19. Clare A, Andiappan M, MacNeil S, Bunton T, Jarrett S. Can a pain management programme approach reduce healthcare use? Stopping the revolving door. *Br J Pain.* 2013; 7:124–129. [PubMed: 26516513]
20. Marks EM, Chambers JB, Russel V, Hunter MS. A novel biopsychosocial, cognitive behavioural, stepped care intervention for patients with non-cardiac chest pain. *Health Psychol Behav Med.* 2016; 4:4.
21. De Hert M, Cohen D, Bobes J, et al. Physical illness in patients with severe mental disorders. II. Barriers to care, monitoring and treatment guidelines, plus recommendations at the system and individual level. *World Psychiatry.* 2011; 10:138–151. [PubMed: 21633691]
22. Swap CJ, Nagurney JT. Value and limitations of chest pain history in the evaluation of patients with suspected acute coronary syndromes. *J Am Med Assoc.* 2005; 294:2623–2629.
23. Chambers JB, Marks EM, Hunter MS. The head says yes but the heart says no: what is non-cardiac chest pain and how is it managed? *Heart.* 2015; 101:1240–1249. [PubMed: 25882503]
24. Fass R, Achem SR. Noncardiac chest pain: epidemiology, natural course and pathogenesis. *J Neurogastroenterol Motil.* 2011; 17:110–123. [PubMed: 21602987]
25. Park SH, Choi JY, Park EJ, et al. Prevalence of gastrointestinal diseases and treatment status in noncardiac chest pain patients. *Korean Circ J.* 2015; 45:469–472. [PubMed: 26617648]
26. Svavarsdottir AE, Jonasson MR, Gudmundsson GH, Fjeldsted K. Chest pain in family practice. Diagnosis and long-term outcome in a community setting. *Can Fam Physician.* 1996; 42:1122–1128. [PubMed: 8704488]
27. Bass C, Chambers JB, Kiff P, Cooper D, Gardner WN. Panic anxiety and hyperventilation in patients with chest pain: a controlled study. *Q J Med.* 1988; 69:949–959. [PubMed: 3270082]

28. Ambardekar AV, Fonarow GC, Dai D, et al. Quality of care and in-hospital outcomes in patients with coronary heart disease in rural and urban hospitals (from Get With the Guidelines-Coronary Artery Disease Program). *Am J Cardiol*. 2010; 105:139–143. [PubMed: 20102907]
29. Barlow DH, Vermilyea J, Blanchard EB, Vermilyea BB, Di Nardo PA, Cerny JA. The phenomenon of panic. *J Abnorm Psychol*. 1985; 94:320–328. [PubMed: 4031229]
30. Katon W. Panic disorder and somatization. Review of 55 cases. *Am J Med*. 1984; 77:101–106. [PubMed: 6377887]
31. Dammen T, Arnesen H, Ekeberg O, Husebye T, Friis S. Panic disorder in chest pain patients referred for cardiological outpatient investigation. *J Intern Med*. 1999; 245:497–507. [PubMed: 10363751]
32. Fleet RP, Dupuis G, Marchand A, Burelle D, Arsenault A, Beitman BD. Panic disorder in emergency department chest pain patients: prevalence, comorbidity, suicidal ideation, and physician recognition. *Am J Med*. 1996; 101:371–380. [PubMed: 8873507]
33. Tully PJ, Turnbull DA, Beltrame J, et al. Panic disorder and incident coronary heart disease: a systematic review and meta-regression in 1131612 persons and 58111 cardiac events. *Psychol Med*. 2015; 45:2909–2920. [PubMed: 26027689]
34. Huffman JC, Pollack MH. Predicting panic disorder among patients with chest pain: an analysis of the literature. *Psychosomatics*. 2003; 44:222–236. [PubMed: 12724504]
35. Foldes-Busque G, Fleet R, Poitras J, Chauny JM, Diodati JG, Marchand A. Suicidality and panic in emergency department patients with unexplained chest pain. *Gen Hosp Psychiatry*. 2012; 34:178–184. [PubMed: 22285369]
36. Al-Ani M, Winchester DE. Prevalence and overlap of noncardiac conditions in the evaluation of low-risk acute chest pain patients. *Crit Pathw Cardiol*. 2015; 14:97–102. [PubMed: 26214812]
37. Carter C, Maddock R, Zoglio M, Lutrin C, Jella S, Amsterdam E. Panic disorder and chest pain: a study of cardiac stress scintigraphy patients. *Am J Cardiol*. 1994; 74:296–298. [PubMed: 8037144]
38. Hocaoglu C, Gulec MY, Durmus I. Psychiatric comorbidity in patients with chest pain without a cardiac etiology. *Isr J Psychiatry Relat Sci*. 2008; 45:49–54. [PubMed: 18587169]
39. Carter CS, Servan-Schreiber D, Perlstein WM. Anxiety disorders and the syndrome of chest pain with normal coronary arteries: prevalence and pathophysiology. *J Clin Psychiatry*. 1997; 58(Suppl 3):70–73. [discussion 4–5]. [PubMed: 9133495]
40. Bass WC, Hand D, et al. Patients with angina with normal and near-normal coronary arteries: clinical and psychosocial state at 12 months after angiography. *Br Med J*. 1983; 6404:1505–1508.
41. Ayers S, Copland C, Dunmore E. A preliminary study of negative appraisals and dysfunctional coping associated with post-traumatic stress disorder symptoms following myocardial infarction. *Br J Health Psychol*. 2009; 14:459–471. [PubMed: 18789186]
42. Gander M-L, von Känel R. Myocardial infarction and post-traumatic stress disorder: frequency, outcome, and athero-sclerotic mechanisms. *Eur J Cardiovasc Prev Rehabil*. 2006; 13:165–172. [PubMed: 16575268]
43. Edmondson D, Kronish IM, Shaffer JA, Falzon L, Burg MM. Posttraumatic stress disorder and risk for coronary heart disease: a meta-analytic review. *Am Heart J*. 2013; 166:806–814. [PubMed: 24176435]
44. Kronish IM, Edmondson D, Li Y, Cohen BE. Post-traumatic stress disorder and medication adherence: results from the Mind Your Heart study. *J Psychiatr Res*. 2012; 46:1595–1599. [PubMed: 22809686]
45. Edmondson D, Rieckmann N, Shaffer JA, et al. Post-traumatic stress due to an acute coronary syndrome increases risk of 42-month major adverse cardiac events and all-cause mortality. *J Psychiatr Res*. 2011; 45:1621–1626. [PubMed: 21807378]
46. Kubzansky LD, Koenen KC, Spiro A, Vokonas PS, Sparrow D. Prospective study of posttraumatic stress disorder symptoms and coronary heart disease in the Normative Aging Study. *Arch Gen Psychiatry*. 2007; 64:109–116. [PubMed: 17199060]
47. Webster R, Norman P, Goodacre S, Thompson A. The prevalence and correlates of psychological outcomes in patients with acute non-cardiac chest pain: a systematic review. *Emerg Med J*. 2012; 29:267–273. [PubMed: 22034535]

48. Boone, K. Somatoform disorders, factitious disorder, and malingering. In: Schoenberg, Mike R., Scott, James G., editors. *The Little Black Book of Neuropsychology*. US: Springer; 2011. p. 551-566.
49. Hamilton JC, Eger M, Razzak S, Feldman MD, Hallmark N, Cheek S. Somatoform, factitious, and related diagnoses in the national hospital discharge survey: addressing the proposed DSM-5 revision. *Psychosomatics*. 2013; 54:142–148. [PubMed: 23274011]
50. Chambers E, Yager J, Apfeldorf W, Camps-Romero E. Factitious aortic dissection leading to thoracotomy in a 20-year-old man. *Psychosomatics*. 2007; 48:355–358. [PubMed: 17600175]
51. Wills BK, Kwan C, Bailey M, Johnson L, Allan N. Recalcitrant supraventricular tachycardia: occult albuterol toxicity due to a factitious disorder. *J Emerg Med*. 2015; 49:436–438. [PubMed: 26162766]
52. Fliege H, Scholler G, Rose M, Willenberg H, Klapp BF. Factitious disorders and pathological self-harm in a hospital population: an interdisciplinary challenge. *Gen Hosp Psychiatry*. 2002; 24:164–171. [PubMed: 12062141]
53. Zvolensky MJ, Feldner MT, Eifert GH, Vujanovic AA, Solomon SE. Cardiophobia: a critical analysis. *Transcult Psychiatry*. 2008; 45:230–252. [PubMed: 18562494]
54. Israel JI, White KS, Farmer CC, Pardue CM, Gervino EV. Heart-focused anxiety in patients with noncardiac chest pain: structure and validity. *Assessment*. 2017; 24(1):95–103. [Epub 2015 Aug 13]. [PubMed: 26271489]
55. Hadlandsmayth K, White KS, Krone RJ. Quality of life in patients with non-CAD chest pain: associations to fear of pain and psychiatric disorder severity. *J Clin Psychol Med Settings*. 2013; 20:284–293. [PubMed: 23338745]
56. Fischer D, Kindermann I, Karbach J, et al. Heart-focused anxiety in the general population. *Clin Res Cardiol*. 2012; 101:109–116. [PubMed: 22015615]
57. Barsky AJ. Clinical practice. The patient with hypochondriasis. *N Engl J Med*. 2001; 345:1395–1399. [PubMed: 11794173]
58. Eifert GH, Thompson RN, Zvolensky MJ, et al. The cardiac anxiety questionnaire: development and preliminary validity. *Behav Res Ther*. 2000; 38:1039–1053. [PubMed: 11004742]
59. Marker CD, Carmin CN, Ownby RL. Cardiac anxiety in people with and without coronary atherosclerosis. *Depress Anxiety*. 2008; 25:824–831. [PubMed: 17597101]
60. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Health Disorders: DSM-5*. Washington, DC: American Psychiatric Publishing; 2013.
61. Denollet J, Sys SU, Stroobant N, Rombouts H, Gillebert TC, Brutsaert DL. Personality as independent predictor of long-term mortality in patients with coronary heart disease. *Lancet*. 1996; 347:417–421. [PubMed: 8618481]
62. Denollet J. Type D personality. A potential risk factor refined. *J Psychosom Res*. 2000; 49:255–266. [PubMed: 11119782]
63. Denollet J, Conraads VM. Type D personality and vulnerability to adverse outcomes in heart disease. *Cleve Clin J Med*. 2011; 78(Suppl 1):S13–S19.
64. Versteeg H, Spek V, Pedersen SS, Denollet J. Type D personality and health status in cardiovascular disease populations: a meta-analysis of prospective studies. *Eur J Prev Cardiol*. 2012; 19:1373–1380. [PubMed: 21965518]
65. Mommersteeg PM, Widdershoven JW, Aarnoudse W, Denollet J. Personality subtypes and chest pain in patients with nonobstructive coronary artery disease from the TweeSteden Mild Stenosis study: mediating effect of anxiety and depression. *Eur J Pain*. 2016; 20:427–437. [PubMed: 26105088]
66. Kuper H, Marmot M, Hemingway H. Systematic review of prospective cohort studies of psychosocial factors in the etiology and prognosis of coronary heart disease. *Semin Vasc Med*. 2002; 2:267–314. [PubMed: 16222620]
67. Haynes SG, Feinleib M, Kannel WB. The relationship of psychosocial factors to coronary heart disease in the Framingham Study. III. Eight-year incidence of coronary heart disease. *Am J Epidemiol*. 1980; 111:37–58. [PubMed: 7352459]

68. Kisely SR, Campbell LA, Yelland MJ, Paydar A. Psychological interventions for symptomatic management of non-specific chest pain in patients with normal coronary anatomy. *Cochrane Database Syst Rev.* 2010; (1):CD004101. [PubMed: 20091559]
69. Mayou RA, Bryant BM, Sanders D, Bass C, Klimes I, Forfar C. A controlled trial of cognitive behavioural therapy for non-cardiac chest pain. *Psychol Med.* 1997; 27:1021–1031. [PubMed: 9300508]
70. Esler JL, Barlow DH, Woolard RH, Nicholson RA, Nash JM, Erogul MH. A brief cognitive-behavioral intervention for patients with noncardiac chest pain. *Behav Ther.* 2003; 34:129–148.
71. Beek M, Oude Voshaar R, Beek A, et al. A brief cognitive-behavioral intervention for treating depression and panic disorder in patients with noncardiac chest pain: a 24-week randomized controlled trial. *Depress Anxiety.* 2013; 30:670–678. [PubMed: 23625592]
72. Jones H, Cooper P, Miller V, Brooks N, Whorwell PJ. Treatment of non-cardiac chest pain: a controlled trial of hypnotherapy. *Gut.* 2006; 55:1403–1408. [PubMed: 16627548]
73. Asbury EA, Kanji N, Ernst E, Barbir M, Collins P. Autogenic training to manage symptomology in women with chest pain and normal coronary arteries. *Menopause.* 2009; 16:60–65. [PubMed: 18978640]
74. DeGuire S, Gevirtz R, Hawkinson D, Dixon K. Breathing retraining: a three-year follow-up study of treatment for hyperventilation syndrome and associated functional cardiac symptoms. *Biofeedback Self Regul.* 1996; 21:191–198. [PubMed: 8805966]
75. Wertli MM, Ruchti KB, Steurer J, Held U. Diagnostic indicators of non-cardiovascular chest pain: a systematic review and meta-analysis. *BMC Med.* 2013; 11:239. [PubMed: 24207111]
76. Wong WM, Beeler J, Risner-Adler S, Habib S, Bautista J, Fass R. Attitudes and referral patterns of primary care physicians when evaluating subjects with noncardiac chest pain—a national survey. *Dig Dis Sci.* 2005; 50:656–661. [PubMed: 15844697]
77. Talley NJ, Ford AC. Functional dyspepsia. *N Engl J Med.* 2015; 373:1853–1863. [PubMed: 26535514]
78. George N, Abdallah J, Maradey-Romero C, Gerson L, Fass R. Review article: the current treatment of non-cardiac chest pain. *Aliment Pharmacol Ther.* 2016; 43:213–239. [PubMed: 26592490]
79. Atluri DK, Chandar AK, Fass R, Falck-Ytter Y. Systematic review with meta-analysis: selective serotonin reuptake inhibitors for noncardiac chest pain. *Aliment Pharmacol Ther.* 2015; 41:167–176. [PubMed: 25412947]
80. Goldstein DJ, Lu Y, Detke MJ, Lee TC, Iyengar S. Duloxetine vs. placebo in patients with painful diabetic neuropathy. *Pain.* 2005; 116:109–118. [PubMed: 15927394]
81. Chappell AS, Bradley LA, Wiltse C, Detke MJ, D'Souza DN, Spaeth M. A six-month double-blind, placebo-controlled, randomized clinical trial of duloxetine for the treatment of fibromyalgia. *Int J Gen Med.* 2008; 1:91–102. [PubMed: 20428412]
82. Chappell AS, Desai D, Liu-Seifert H, et al. A double-blind, randomized, placebo-controlled study of the efficacy and safety of duloxetine for the treatment of chronic pain due to osteoarthritis of the knee. *Pain Pract.* 2011; 11:33–41. [PubMed: 20602715]
83. Marks EM, Chambers JB, Russell V, Bryan L, Hunter MS. The rapid access chest pain clinic: unmet distress and disability. *QJM.* 2014; 107:429–434. [PubMed: 24448381]
84. Kinsinger SW, Ballou S, Keefer L. Snapshot of an integrated psychosocial gastroenterology service. *World J Gastroenterol.* 2015; 21:1893–1899. [PubMed: 25684957]
85. Stone J, Carson A, Sharpe M. Functional symptoms in neurology: management. *J Neurol Neurosurg Psychiatry.* 2005; 76(Suppl 1):i13–i21. [PubMed: 15718216]
86. Pogossova NSH, Pedersen SS, Cupples ME, et al. Psychosocial aspects in cardiac rehabilitation: from theory to practice. A position paper from the Cardiac Rehabilitation Section of the European Association of Cardiovascular Prevention and Rehabilitation of the European Society of Cardiology. *Eur J Prev Cardiol.* 2015; 22:1290–1306. [PubMed: 25059929]
87. Stone J, Wojcik W, Durrance D, et al. What should we say to patients with symptoms unexplained by disease? The “number needed to offend. *Br Med J.* 2002; 325:1449–1450. [PubMed: 12493661]
88. Marks EM, Hunter MS. Medically unexplained symptoms: an acceptable term? *Br J Pain.* 2015; 9:109–114. [PubMed: 26516565]

89. Stewart M, Brown JB, Donner A, et al. The impact of patient-centered care on outcomes. *J Fam Pract.* 2000; 49:796–804. [PubMed: 11032203]
90. Webster R, Norman P, Goodacre S, Thompson AR, McEachan RR. Illness representations, psychological distress and non-cardiac chest pain in patients attending an emergency department. *Psychol Health.* 2014; 29:1265–1282. [PubMed: 24831735]
91. Huffman JC. Essential articles on collaborative care models for the treatment of psychiatric disorders in medical settings: a publication by the Academy of Psychosomatic Medicine Research and Evidence-Based Practice Committee. *J Clin Psychiatry.* 2014; 55:109–122.
92. Rose G, McCartney P, Reid DD. Self-administration of a questionnaire on chest pain and intermittent claudication. *Br J Prev Soc Med.* 1977; 31:42–48. [PubMed: 856370]
93. Cooke RA, Smeeton N, Chambers JB. Comparative study of chest pain characteristics in patients with normal and abnormal coronary angiograms. *Heart.* 1997; 78:142–146. [PubMed: 9326987]
94. Drossman DA. Functional gastrointestinal disorders: history, pathophysiology, clinical features, and Rome IV. *Gastroenterology.* 2016; 150:1262–1279. e2.
95. Caudill M. Decreased clinic use by chronic pain patients: response to behavioral medicine intervention. *Clin J Pain.* 1991; 7:305–310. [PubMed: 1809444]
96. Keefer L. The effects of relaxation response meditation on the symptoms of irritable bowel syndrome: results of a controlled treatment study. *Behav Res Ther.* 2001:39.
97. Abbass ACS, Magee K, et al. Intensive short-term dynamic psychotherapy to reduce rates of emergency department return visits for patients with medically unexplained symptoms: preliminary evidence from a prepost intervention study. *CJEM.* 2009; 11:529–534. [PubMed: 19922712]
98. Kashner RK, Cohen B, et al. Enhancing the health of somatization disorder patients. Effectiveness of short-term group therapy. *Psychosomatics.* 1995; 36:462–470. [PubMed: 7568654]
99. Lahmann CLT, Tritt K, Nickel M. Efficacy of functional relaxation and patient education in the treatment of somato-form heart disorders: a randomized, controlled clinical investigation. *Psychosomatics.* 2008; 49:378–385. [PubMed: 18794505]

APPENDIX 1

Psychotherapeutic interventions	Major principles	Goals in NCCP
Cognitive behavioral therapy	Thoughts, feelings, and behaviors are inter-related. Automatic thoughts and cognitive distortions can result in maladaptive behaviors.	Identify and correct misperceptions, misattributions, and cognitive distortions related to chest pain to improve function and modify maladaptive behaviors (e.g., recurrent ED visits). ^{69–71}
Mindfulness-based therapy Mindfulness-based stress reduction (MBSR) Meditation Relaxation response Relaxation therapy	By maintaining full attention to and awareness of the moment, one can disengage from beliefs, thoughts, and emotions, and develop a greater sense of emotional stability and well-being.	Maintain full attention to and awareness of the moment to disengage oneself from all beliefs, thoughts, and emotions, including those related to chest pain. ^{95,96*}
Hypnosis	Inducing a state of deep relaxation or trance provides access to an open state of mind amenable to the therapist's suggestions.	Change beliefs about chest pain and behaviors related to those beliefs by offering suggestions for change during a state of deep relaxation or
Psychodynamic therapy	Awareness of the unconscious interpretation, achieved through examination of past experiences and relationships, can affect current thoughts and behaviors.	Identify how the unconscious interpretation is driving current thoughts about and behaviors related to chest pain to improve function. ^{97*}
Group therapy	Sharing thoughts, feelings, and experiences in a group setting can facilitate improved insight and associated change through normalization and shared empathy.	Share and learn from peers with similar experiences of chest pain to improve insight about symptoms and mobilize change. ^{98,99*}

* Tested in patients with medically unexplained symptoms, somatic symptom, and related disorders, or chronic pain, not specifically in NCCP.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

TABLE

Selected etiologies of chest pain

	System	Disease
Cardiac chest pain	Cardiac	Ischemic
		Acute coronary syndrome
		Stable angina
		Valvular dysfunction
		Vascular spasm
		Vascular
		Aortic or coronary artery dissection
		Pericarditis
		Microvascular disease
		Inflammatory/infiltrative
		Autoimmune
		Drug-induced (clozapine)
		Infectious (viral and bacterial myocarditis)
		Pericardial effusion/cardiac tamponade
		Structural heart disease (hypertrophic cardiomyopathy)
		Acute heart failure
Non-cardiac chest pain	Gastrointestinal	Gastroesophageal reflux disease
		Gastric or duodenal ulcer
		Esophageal rupture
		Esophageal dysmotility or spasm
		Esophageal hypersensitivity
		Pancreatitis
		Biliary colic
		Cholelithiasis
		Choledocholithiasis
		Splenomegaly
		Diaphragmatic irritation
		Eosinophilic esophagitis
	Pulmonary	Pulmonary embolism
		Pneumothorax
		Pneumonia
		Malignancy
		Chronic obstructive pulmonary disease
	Musculoskeletal	Pleural effusion or pleuritis
		Pulmonary hypertension
		Costochondritis
		Traumatic injury
		Thoracic overbreathing pattern
		Cervical rib
		Thoracic outlet syndrome

System	Disease
Psychiatric	Generalized anxiety disorder
	Panic disorder
	Major depressive disorder
	Illness anxiety disorder
	Cardiophobia
	Somatic symptom disorder
	Deception syndromes
	Substance use disorders (cocaine, methamphetamines, and alcohol)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript