REVIEW

The Diagnostic Workup, Screening, and Treatment Approaches for Patients with Delusional Infestation

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ABSTRACT

Delusional infestation (DI) is a psychiatric disorder defined by the fixed, false belief that one has been infested by an organism without evidence to support this. Patients may present with skin lesions and report abnormal cutaneous sensations. The diagnostic workup for patients presenting with delusional infestation is essential to ensuring accurate diagnosis in ruling out other explanations for symptoms and investigating potential secondary causes of DI. In addition to a comprehensive history and physical examination, laboratory workup should be considered depending on the clinical picture. Antipsychotic medications are the most common drugs used in management of adults with DI and tailor the choice of treatment according to patient characteristics. This article serves as a guide for dermatologists, psychiatrists, and other clinicians as it reviews the workup and screening that should be considered when managing a patient with delusional infestation and subsequent treatment protocols once the diagnosis has been made.

Keywords: Delusional infestation; Psychodermatology; Psychocutaneous medicine; Pruritus; Pharmacology; Antipsychotics; Psychotherapy; Management; Multi-pronged protocol; Clinician guidelines

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Key Summary Points

The differential diagnosis of delusional of infestation is extensive and, depending on the clinical picture, the workup spans multiple specialties, including hematology, oncology, hepatology, nephrology, endocrinology, infectious diseases, neurology, psychiatry, immunology, and dermatology.

Etiologies to explain delusional infestation, primary or secondary, can be complex, and associated conditions require additional confirmation through research studies.

Delusional infestation should be considered a diagnosis of exclusion.

Delusional infestation management should begin with patient education on a multi-pronged protocol that includes social support, pharmacologic therapies, and, when possible, psychotherapy, and self-managed lifestyle modifications.

INTRODUCTION

Delusional infestation (DI) is a psychiatric disorder characterized by a fixed, false belief that one has been infested by an organism in the absence of objective data to support this belief [1, 2]. Dermatologic complaints are the most common, but perceived parasitosis of the gastrointestinal system has been reported [2]. The German term Dermatozoenwahn, meaning "delusion of an insect infestation," was first used by Karl Ekbom in 1938 to describe this condition [3]. The eponymous alternative name for DI, Ekbom's syndrome, was historically used but is now considered ambiguous because of its association with restless leg syndrome (RLS) [3]. DI is also known as pseudoparasitic dysesthesia or acarophobia [1, 3, 4]. This review article is based on previously conducted studies and does

not contain any new studies with human participants or animals performed by any of the authors.

DI may be primary, with no identifiable etiology, and in which delusional infestation is the only presenting symptom. DI may also be secondary to another medical condition, psychiatric condition, or substance intoxication [5]. Treatment of primary DI is antipsychotics. The treatment of secondary DI should address the underlying cause [6].

Patients with DI may report skin lesions and abnormal cutaneous sensations, including formication, paresthesia, pruritus, and extrusion of material from the skin. Formication is the perception of an organism crawling, stinging, or biting when no such organism is present to account for the sensation. It is a tactile hallucination [2]. In contrast to DI, patients with formication do not have a fixed, false belief that their symptoms are due to infestation. Patients with DI may present with a fixation on inanimate materials or objects such as fibers. These patients often bring such materials to the clinic as "specimens" for evaluation and to demonstrate "proof" of infestation [1, 3]. This was classically known as the "matchbox sign," and this term has now been replaced with "specimen sign." The substances collected can include skin debris, hair, fibers of plant or animal origin, dust, and photographs of skin lesions or parasites [3]. DI typically affects adults in their 5th decade of life and has a female predominance. Up to 80% of patients report a history of or current comorbid psychiatric conditions such as depression, anxiety, and substance abuse disorders [3].

Due to the reluctance of patients with psychotic disorders to seek evaluation by mental health professionals, patients with DI often present first to dermatologists. Therefore, understanding the medical workup for patients presenting with complaints consistent with DI is vital to proper patient care. The general approach to the workup of a patient presenting with possible DI is, first and foremost, a thorough clinical evaluation. It is important to rule out organic disease as DI is a diagnosis of exclusion. True infestation, dermatologic conditions, and other potential explanations for

symptoms must be investigated and ruled out [2]. It is also important to rule out infections such as HIV, hepatitis, and syphilis.

Examination typically does not reveal any primary skin lesion. Secondary skin lesions such as excoriations, erosions, ulcers, hypo- or hyper-pigmentation, and scars may be present. Skin biopsies can be performed to reassure the patient with common findings, including, excoriation, ulceration, erosion, and non-specific inflammation [2].

Differential diagnoses of DI include scabies incognito, Grover's disease, dermatitis induced by mites, pets, caterpillars, moths, or fiberglass, substance-induced sensory disturbances, neurologic disease, systemic disease, and other psychiatric conditions [1, 3]. The goal of laboratory testing and imaging, when clinically relevant, is to rule out alternative explanations for symptoms and assess for secondary causes of DI. The following screening tests should be considered.

Ethical Approval

This review article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

Complete Blood Count

A complete blood count (CBC) should be performed to assess for eosinophilia, which is a laboratory indicator of true parasitic infestation [7]. A CBC can reveal iron deficiency anemia, megaloblastic anemia, polycythemia vera, and hematologic malignancy. Iron deficiency and vitamin B12 deficiency have been associated with DI in case reports [8, 9]. Additionally, both hematologic and systemic malignancies can present with paraneoplastic pruritus. Polycythemia vera can present with aquagenic pruritus [10, 11].

Complete Metabolic Panel

Pruritus is a common symptom of chronic liver disease. It is especially common in cholestatic diseases, such as primary biliary cirrhosis, intrahepatic cholestasis of pregnancy, hepatitis B, and hepatitis C [12]. Hepatic disease can also present with encephalopathy. Performing a comprehensive metabolic panel (CMP) to assess liver function can reveal possible underlying hepatobiliary disease.

Pruritus is also a common symptom of chronic kidney disease. Though its precise pathogenesis remains unknown, electrolyte imbalances (particularly in calcium and phosphorus), dehydration, hyperparathyroidism, and uremia-induced systemic inflammation have been implicated. Measuring BUN, creatinine, and electrolytes may reveal a renal etiology of pruritus [10].

Evidence suggests that chronic endocrinologic changes may exacerbate the condition of DI. Though there are several cases of delusions of infestations occurring in diabetics, more research on hormonal and metabolic changes is needed to establish a definitive link between DI and comorbidities like diabetes [13, 14].

Thyroid Function Panel

Thyroid dysfunction can cause an array of neuropsychiatric disturbances. Some reports suggest that hyperthyroidism can cause psychotic symptoms such as DI. However, these reports are rare. Hypothyroidism has also been linked to psychotic symptoms. Therefore, in patients presenting with symptoms of delusional infestation, a thyroid function panel is a prudent component of the diagnostic workup [15].

Urinalysis and Urine Toxicology Screening

Urinalysis can measure urobilinogen and conjugated bilirubin. Elevations in conjugated bilirubin and both elevations and depressions in urobilinogen are associated with hepatobiliary pathology. Biliary obstruction can result in bile acid deposition in the skin, causing pruritus [16]. Urinalysis can also reveal dehydration, which is a proposed mechanism for pruritus in chronic kidney disease [10]. A urinalysis can also assess for mast cell metabolites and

prostaglandins, which are elevated in systemic mast cell activation syndromes [17]. Urinary 5-HIAA levels can be measured to rule out serotonin syndrome. Both mast cell activation syndrome and serotonin syndrome can present with pruritus [18].

Urine drug screening should be performed in the workup for DI because the use of substances such as cocaine, methamphetamine, and methylphenidate can cause tactile hallucinations. Alcohol withdrawal is also associated with formication, and cases of DI associated with a history of long-term alcohol abuse have been reported [19]. Notably, the delusional infestation that occurs in delirium tremens is distinct from true delusional infestation. Other medications such as monoamine oxidase inhibitors, antidepressants, stimulants, amantadine, ciprofloxacin, topiramate, ketoconazole, and corticosteroids have been associated with DI [7, 19–21].

Human Immunodeficiency Virus (HIV)

In a case report, DI was noted as a presenting symptom of HIV dementia [22]. Patients assessed to be at risk for HIV infection should be screened.

Hepatitis

In a case report, DI was described in association with hepatitis C infection during treatment with interferon. When treatment with interferon was discontinued, the delusions disappeared. When treatment was reinitiated, the delusional infestation reappeared [23]. Pruritus is also a common feature of chronic liver disease, including chronic hepatitis B and C infections [12].

Vitamin D

Huber et al. performed the first study evaluating structural MRI findings in patients with DI and relating them to possible mechanisms of pathogenesis. They found that lesions in the striatum (putamen), a part of the basal ganglia responsible for motor coordination and visuotactile perception, were associated with DI secondary to a medical cause. These findings were not seen in primary DI cases or in DI cases secondary to psychiatric disorders. They proposed that a striato-thalamo-parietal pathway controls the tactile hallucinations and somatic delusions seen in patients with DI. This is supported by a study of a patient with a hypophyseal tumor involving the hypothalamus and thalamus and associated atrophy of the frontal and parietal cortices who presented with DI. Furthermore, they described the improvement of DI symptoms with anti-dopaminergic medications and exacerbation with dopaminergic substances (e.g., cocaine, stimulants, bupropion), suggesting dopamine dysregulation may be implicated in DI [24].

Vitamin D plays a protective role for dopaminergic neurons and increases dopamine levels in the nigrostriatal pathway. In RLS, vitamin D deficiency has been proposed as a possible predisposing factor and was found to be significantly associated with RLS [25]. If dopaminergic dysfunction plays a role in the pathogenesis of DI, it is possible that the effects of vitamin D deficiency on dopaminergic pathways could lead to disease.

Vitamin B12

Vitamin B12 deficiency manifests with classic hematologic and neurologic signs. These include megaloblastic anemia, peripheral neuropathy, hyporeflexia, loss of proprioception, loss of sensation to vibration, cognitive impairment, and psychosis [26]. A case report of a 43-year-old woman with a history of depression and new onset DI reported that the patient had a nearly undetectable vitamin B12 level. A treatment regimen incorporating an anti-depressant, an antipsychotic, and vitamin B12 repletion improved the patient's symptoms. Therefore, vitamin B12 may play a role in the development of delusional infestation [8]. For this reason, a similarly presenting deficiency in vitamin B9 (folate) should also be considered in patients presenting with neurologic symptoms.

Vitamin B3

A case report presented a 45-year-old male with classical signs of pellagra presenting with psychiatric symptoms and complaints of insects infesting his abdomen. During the evaluation, he was found to have cognitive impairment, a scaly rash in sun-exposed distribution, and a history of diarrhea. Due to resource limitations, confirmatory testing was not performed for niacin deficiency. However, within days of starting treatment with antipsychotic medication and a vitamin B complex supplement, his delusional symptoms improved. The rapid resolution of his symptoms, as well as the association of niacin deficiency with schizophreniform disorders, mood disorders, and anxiety disorders, suggests it may also contribute to the pathogenesis of DI [27].

Iron

A case report presented a 49-year-old woman presenting for DI of 18-month duration. On laboratory workup, severe iron deficiency anemia was found. Her hemoglobin was 3.4 g/dl, and she was subsequently treated with transfusion with PRBCs and iron supplementation in the emergency department. At re-evaluation 2 months later, her delusions had completely dissipated [9]. This suggests iron deficiency may contribute to the development of DI.

Neurologic Imaging

DI has been reported as a presenting symptom of cerebrovascular accident [28, 29]. Therefore, in elderly patients or in those with risk factors for cerebrovascular disease, neuroimaging to investigate the cause of symptoms is recommended. DI has also been reported as a symptom in patients with neurocysticercosis, vitamin B12 deficiency dementia, multiple sclerosis, pituitary and other central nervous system tumors, head injuries, Parkinson's disease, Huntington's disease, encephalitis, meningitis, and learning disabilities [19, 30, 31]. Neuroimaging may be of diagnostic utility if

there is high clinical suspicion for these conditions [24].

Approach to Patient-Centered DI Treatment

DI is a psychiatric disorder, but many patients present initially to dermatologists for evaluation [1, 32]. A comprehensive laboratory workup–in addition to a thorough evaluation of patient-supplied samples, skin biopsies, cultures, and stool sample testing–not only narrows the differential diagnosis but also serves to reassure the patient [1, 33]. Moreover, the diagnostic approach to DI should view this psychodermatologic condition as a diagnosis of exclusion (DOE) with continuous, proactive surveillance of symptomatology and patient behavior improvements or changes [6, 33–35]. Furthermore, fostering a strong physician-patient therapeutic alliance is imperative to the successful treatment of DI and can extend the support felt by the patient beyond the clinical setting [6, 36]. Treatment considerations should not only weigh the benefits and risks of the therapeutic option but, more importantly, take a multi-pronged approach that includes pharmacologic agents, along with psychotherapy (whenever possible) and physician support, to optimize the patient's improvement [6, 33, 36, 37].

Pharmacologic Agents

Pharmacologic treatment with antipsychotic medications is a mainstay of treatment for primary DI. Pimozide has the most supportive literature for effectiveness in treating DI [1, 38–41]. However, the notable side effects, including cardiac abnormalities and extrapyramidal side effects, no longer merit it being the treatment of choice by many dermatologists [1, 42–44]. Therefore, pre-treatment ECG is necessary to verify that the patient does not have a pre-existing arrhythmia, QT interval prolongation, or conduction abnormalities [1]. Extrapyramidal side effects can be managed by using diphenhydramine, benztropine or by switching to a second-generation or atypical

antipsychotic [1]. The preferred alternatives to pimozide are risperidone, amisulprode, aripiprazole, quetiapine, and olanzapine in age-appropriate doses [1, 6, 42–44]. These medications have a relatively more favorable side effect profile [1, 6, 43–45]. Due to the risk of bone marrow suppression associated with atypical antipsychotics, a baseline CBC should be performed prior to initiating treatment and monitored at 1 month, 6 months, and 1 year during treatment. A fasting lipid panel, HbA1c, and fasting glucose should be monitored because of the increased risk of metabolic syndrome with atypical antipsychotic use [1, 35]. Obesogenic effects of atypical antipsychotics culminate in metabolic syndrome because of their various alterations in adipocyte differentiation and gene expression for leptin [45]. In particular, patients taking olanzapine or amisulpride should also be monitored for hyperprolactinemia, which can present with amenorrhea, galactorrhea, sexual dysfunction, and low bone density [1, 35, 45].

Literature supports approximate starting dosing ranges of risperidone at 1–8 mg/day, amisulpride at 200–400 mg/day, aripiprazole at 15–30 mg/day, quetiapine at 200–600 mg/day (100—300 mg every 12 h), and olanzapine at 5–20 mg/day [6, 33, 35, 45–47]. Additional considerations for the treatment of DI in elderly patients require lowering doses to avoid adverse effects, especially those affecting hepatic and renal function [6].

Aripiprazole and quetiapine have been implicated as potential DI treatments, yet not enough studies exist to support their use definitively. In one case, a patient was prescribed high-dose quetiapine at 800 mg/day. Improvement was not seen until physicians eventually switched to pimozide (4 mg/day) which had greater efficacy in achieving remission for the patient.

Moreover, a relative of this patient with folie-à-deux saw significant improvement in their shared delusional infestation disorder with as little as 1 mg/day of risperidone [48]. The delay in symptom improvement for a challenging psychodermatologic condition like DI makes loss to follow-up a threatening reality for randomized controlled trial research [39, 40, 47].

Current evidence extensively backs risperidone and olanzapine as having fewer adverse side effects [1, 33, 42, 45, 47, 48]. Though case-based analyses by Freudenmann et al. show maximal efficacy for most antipsychotics occurs after at least 6 weeks of continued regimen, notable improvements like partial or full remission of DI with risperidone (69% of the sampled patient population) or olanzapine (72%) cannot be ignored [49]. Still, randomized controlled trials need to be conducted to confirm efficacious dosing schedules for the optimization of DI treatment protocols [6, 33, 44, 45]. More results like these may support shifts in treatment best practices as physicians become comfortable recommending newer antipsychotics for the effective treatment of DI [6, 35, 45–47].

Limiting conditions aside, suggesting olanzapine as the first-line option for a formalized DI protocol means addressing the most problematic adverse effects of sedation and weight gain with supportive therapy. Sedative effects can be addressed by advising patients to take their dosage at night, and weight gain can be proactively controlled with pharmaceutical options and lifestyle management support (i.e., physical fitness and nutritional counseling) [34, 50–55]. Currently, strategies to diminish the weight gain effects of olanzapine can be borrowed from methods used for patients with schizophrenia taking olanzapine for long-term treatment [51–55].

Significant weight gain (defined as $> 10\%$ from baseline) at 6-month follow-up was reportedly 12% less ($p = 0.003$) in patients taking olanzapine with a μ-opioid receptor antagonist, samidorphan, compared to olanzapine alone (number needed to treat = 7.29; odds ratio = 0.50; 95% CI = 0.31–0.80) [52]. Moreover, meta-analysis findings of four studies on the effects of metformin with olanzapine versus placebo with olanzapine suggest that adjunctive metformin may be effective (weighted mean difference of − 5.02 kg at 3 months; 95% CI = 3.93–6.10) for the short-term management of olanzapine-related weight gain [53]. Further research may need to be done to confirm significant findings for patients with DI, specifically on olanzapine and metformin versus those

without metformin. Finally, topiramate has shown preliminary efficacy in significantly opposing the adverse effects of olanzapine through the reduction in body weight and BMI compared to the control [54]. However, confounding factors (e.g., socio-cultural and environmental) are suspected, as significant reductions in these measures were also seen depending on the sampled global population [54]. Overall, the reduction of side effects by choice of medical management for DI can improve patient adherence and potentially health outcomes as well [44, 56].

Psychotherapy

Current treatment methodologies suggest that offering psychiatric referrals is met with relatively low patient compliance [6, 33, 47, 57]. Patient indications for lack of follow-up with psychotherapy and psychiatry surround the stigma behind seeking mental health treatment, lack of knowledge or acceptance of the psychologic manifestations of DI; preference for managing one's distress from the comfort of their own home, or inability to prioritize care with additional health providers due to existing obligations [1, 6, 33, 34, 44, 47]. To improve rates of patient adherence to psychiatric referrals and potential health outcomes, spending time on patient education about DI and its treatment options is important [34, 44, 57].

Within the initial encounter, physicians can help reduce the stigma of DI by not rushing to point out its sole etiology as anxiety-based [57]. Doctors can instead explain their investigative role as one in which they evaluate and eliminate potential other causes of their patient's infestation. However, given that one differential diagnosis, DI, is indeed a psychodermatologic one, it may require a longer treatment protocol that advances pharmacologic and psychologic support to overcome cutaneous discomfort.

Understanding that long-term and stubborn causes for "infestation" do exist in the current differential, taking a proactive approach to combat any psychodermatologic etiology means starting the lengthy DI treatment protocol now while upholding patients' mental fortitude. Empowering patient autonomy in this way will demonstrate to the patient that they can have a role in expediting their own care outside of the clinical setting to significantly reduce their distress while other causes for the condition are still explored. Concluding the encounter with plans for the next follow-up will set the tone for this being a working diagnosis that may evolve over time to better explain the patient's symptoms, but in the meantime, the patient is encouraged to find ways to fortify their mental wellness [46, 57].

Though patients may be reluctant to seek psychiatric care, it is important to explain that the burden of the disease or lack of definitive clinical evidence may weigh on the psyche of afflicted individuals [1, 6, 33, 44, 56, 57]. Freudenmann and Lepping further explain that DI also severely impacts the quality of life of patients and that during its clinical management patients can experience a range of emotional distress, from frustration to suicidality [58]. Accepted methodologies for psychotherapy support of DI may be introduced alongside psychiatric care. For instance, the British Academy of Dermatologists recently suggested the support of a multidisciplinary team that included psychotherapy modalities to provide support for the mental health burden of this disease as well as the presence of comorbid chronic or psychologic disorders [35]. Some evidence has suggested that psychotherapy, like cognitive behavioral therapy (CBT), may be helpful in addressing the distressful aspects of DI, though it may not necessarily reverse the core delusion [59]. Further evidence for CBT when applied to delusion and distress is suggested by Freeman on a theoretical basis that this modality of therapy may be able to challenge the core beliefs surrounding a delusion. Freeman et al. also suggests that patients may work on fostering feelings of hope and self-worth as well as increasing their engagement in "positive activities" [60]. Some supplemental activities that have been suggested in other literature include "yoga, meditation, mindfulness, aerobic exercise, relaxation techniques, journaling, hypnosis, acupuncture, and biofeedback," but these may not be appropriate for all patients and

require consideration of the full clinical picture before being tailored to a patient's recommended treatment course [34].

These activities and psychotherapy may also be helpful when comorbidities present patient-specific challenges to remission in complex DI cases [61, 62]. Common comorbidities include depressive disorders, anxiety disorders, obsessive-compulsive disorder, personality disorders, substance use disorders, body dysmorphic disorder, and eating disorders [63]. In fact, a retrospective study over a 7-year period by the Mayo Clinic supported that most of their patients with DI who progressed to a psychiatric consult were diagnosed with a comorbid psychiatric condition (*n* = 54, 40/54 = 74%) [64]. Similar clinical results appear in other publications (e.g., Journal of Medical Internet Research Dermatology, Advances in Psychosomatic Medicine, Acta Dermato-Venereologica) suggesting that DI may not always be simplified to a stand-alone diagnosis [63, 65, 66]. Given that psychogenic excoriation can result from DI in some cases, this potentially expands psychotherapy options to include dialectical behavioral therapy, psychodynamic therapy (insight-oriented), and acceptance-enhanced behavioral therapy (AEBT) [67]. In particular, AEBT is a combination of habit-reversal training with acceptance and commitment therapy that has led to significant improvements in psychogenic excoriation behavior patterns [34, 67]. The theoretical basis behind AEBT, which aims to disassemble complex psychodermatologic and automatic behavior patterns, may show promise for the treatment of DI in patients with comorbid excoriation disorder as well [62, 67]. Thus, psychotherapy may bring some value to patients managing stressors associated with DI (i.e., treatment duration, relapse, frustration, side effects) or comorbid conditions (e.g., depression, anxiety, excoriation disorder) and offer a basis by which therapy and supplemental self-care may benefit the overall mental health of the patient.

Physician Support

Primarily, the opportunity to bolster patient autonomy and provide quality care through a strong doctor-patient relationship exists in the face of psychodermatologic challenges like DI [56]. Though some studies suggest that "specimen signs," for example, should be discouraged or immediately dispelled, there is a missed opportunity here for physicians to observe and support patient progression to recovery [32, 33]. For a DOE like DI that requires enduring support for patients to overcome their health challenges, continued communication and dermatologic surveillance can be expected as a cornerstone of quality care [6, 36, 56, 68]. Moreover, empathy and active listening, along with detailed documentation at each visit, can improve the patient's compliance and satisfaction [56]. Both measures enhance the patient experience and are associated with improved health outcomes [36, 56, 68, 69]. Ergo, there may be therapeutic value in maintaining a strong doctor-patient relationship that does not deny or invalidate the concern of patients with DI as it is grounded in empathy and mutual respect [33, 36].

Finally, to further understand this psychodermatologic condition from the patient's perspective, doctors can even conduct a thorough assessment of the emotional frustrations, interruptions to daily activities, physical limitations, sleep patterns, and persistent stressors brought forth by DI [33, 34, 36]. Following this, they may offer skill-based learning and resources to patients for the management of DI, which ultimately could make clinical follow-ups more efficient. One such resource could be a tracking log or a diary that the patient keeps that follows their behaviors related to DI (i.e., specimen collecting, excoriation, scraping, researching, or shared delusions) on a weekly basis. Thus, physicians can offer support by taking time to glean a clearer understanding of just where the patient is in their journey to recovery from DI [6, 70].
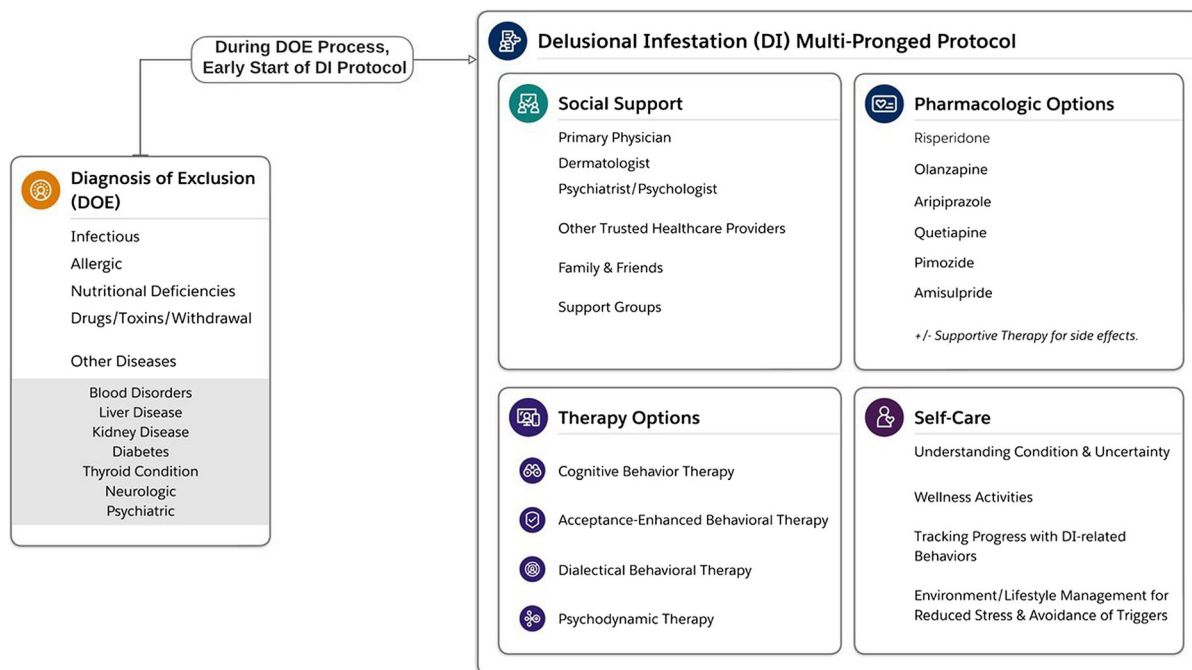
Fig. 1 Patient protocol for long-term management of DI-like symptoms. As a DOE, DI can be explained as a psychodermatologic condition that requires a multi-pronged treatment protocol that involves therapeutic support for both psychologic and dermatologic health. As previously suggested, shared decision-making can involve doctors proposing that a patient begin their treatment protocol while other causes for their symptoms are still being investigated. This is because DI treatment may require a longer duration of psychologic and dermatologic support–giving the patient an opportunity to fortify their mental health. In patients with significant distress or psychiatric comorbidities, options like therapy and self-care may help in their overall wellness and management of mental health. Validating patient concerns and empowering patient autonomy early on may significantly improve patient adherence to seeking psychologic support

Patient Protocol for Long-Term Management of Care

Important considerations for the treatment of DI include a clear path for patients to understand the multi-pronged approach to their care. Clinical introduction to the following protocol, seen in Fig. 1, may benefit patients. This protocol is designed to give equal weight to the four sections of care management that are a concerted effort between the patient and their care team [6, 34, 39, 45, 61]. However, the true visualization of the tailored clinical approach to DI management may require a deep understanding of an individual patient's needs and which of these areas of management may be most applicable to their recovery. This protocol also helps inform patients of treatment expectations and aids physicians in guiding a discussion about their progression in individualized care management.

Meanwhile, physicians will also work concurrently through the DOE process. It may then be beneficial to discuss patient behaviors as *DI-like* symptoms and not as the symptomatology of a formalized (and perhaps premature) diagnosis of DI given the stigma surrounding it [6, 57]. Furthermore, paradigm shifts to educate and empower patients on their role in DI management can be bolstered by the key physician belief that the current working diagnosis can evolve as the physician surveils other etiologies of infestation in the face of dermatologic improvements. In other words, though a patient may be on the path of DI protocol management, physicians will continue to stay

informed about diagnostic advancements and investigate other etiologies until DI is ultimately confirmed as a DOE [35, 44, 57].

CONCLUSION

Delusional infestation (DI) is a psychiatric disorder characterized by somatic delusional infestation by a pathogen. The initial evaluation should focus on ruling out true infection and other causes of pruritus and abnormal cutaneous sensations. Often, skin biopsies, stool ova and parasites (O&P) test, and cultures are necessary for judicious diagnosis and patient reassurance. The main goal of subsequent laboratory testing and imaging is to follow the DOE to the diagnosis of DI. DOE findings can further elucidate whether this is primary or secondary, DI which has implications for advancing treatment. CBC, CMP, urinalysis, urine toxicology, vitamin testing, and neuroimaging are prudent tests that should be considered when clinically relevant to screen for differential diagnoses and causes of secondary DI. Systemic conditions that have been linked with DI in the literature include diabetes mellitus, heart failure, CAD, arrhythmia, hyperparathyroidism, panhypopituitarism, acromegaly, pneumonia, tuberculosis, and leprosy [19, 31]. It is imperative to be vigilant for medical causes of secondary DI and conditions that can closely resemble its presentation to ensure patients are accurately diagnosed [46]. As the differential diagnosis of their "infestation" narrows, patients can work on combating potential DI with consistent pharmacologic and psychologic therapy as needed [6, 38, 45, 46]. Vigilance in patient education, including a treatment protocol for DI, is also essential [34, 43, 44, 56, 57]. The multi-pronged approach of the suggested protocol works to build patient autonomy, knowledge, adherence, and behavior tracking, which may culminate in significantly greater health outcomes and the eventual successful treatment of DI [34, 44, 46, 56, 57].

Declarations

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