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Itch: Epidemiology, clinical presentation, and diagnostic workup

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Abstract

Itch, or pruritus, is the uncomfortable sensation underlying the desire to scratch. Itch is a very common complaint in the general population that can result from dermatologic, systemic (eg, renal, hepatobiliary, endocrine), paraneoplastic, neuropathic, and psychogenic etiologies. Chronic itch is associated with significant sleep disturbances and profoundly reduces overall quality of life. Certain populations, including elderly and African Americans, are at increased risk of experiencing heightened burden of itch. Because of the variable clinical presentation and wide-ranging etiologies, itch presents a challenge for clinicians. The initial evaluation should include a complete blood count, with differential, hepatic, renal, and thyroid function testing along with diabetes screening. Further testing should be guided by history and physical examination findings. There should be a heightened concern for underlying malignancy in individuals older than 60 years of age who have a history of liver disease and diffuse itch less than 12 months of duration. For individuals with chronic pruritus of unknown origin, increased blood eosinophils may serve as a biomarker of T helper cell type 2 polarization and response to immunomodulator therapies. In this first part of a 2-part continuing medical education series, we describe the broader epidemiology and specific conditions associated with itch and the clinical presentation and diagnostic workup for patients with itch.

Keywords

clinical features; diagnostic workup; epidemiology; itch; pruritus

EPIDEMIOLOGY OF ITCH

Key points

- Itch is a highly prevalent symptom in the general population, especially among the elderly.

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None.

- African Americans are at increased risk of experiencing chronic pruritus and associated comorbidities and have more-severe reductions in multiple quality of life domains.

Prevalence

Itch, or pruritus, is a common symptom that leads to more than 7 million ambulatory visits annually in the United States. It is among the 50 most prevalent conditions worldwide.[1,2] The estimated lifetime prevalence of chronic pruritus (itch lasting >6 weeks) ranges between 8% and 25.5%, as reported by several European population-based studies,[3–6] whereas the 12-month cumulative-incidence of chronic pruritus is approximately 7%.[5]

Impact on quality of life

Itch can be as debilitating as chronic pain.[7,8] Patients with chronic pruritus had lower reported overall health-related quality of life than patients with a history of a stroke.[8] Patients with itch often experience sleep disturbances,[9] mood disorders,[10,11] and negative psychosocial impact,[3,12] culminating in a significant overall reduction in quality of life.

Age

Chronic itch is especially common among the elderly, affecting approximately 11.5% −25% of the elderly, especially those older than 85 years of age.[13] Multiple factors contribute to itch in older patients. Older individuals are at increased risk of xerosis and neuropathy as well as the systemic and psychiatric diseases associated with pruritus.[14,15] Age-related physiologic changes, including the progressive loss of skin barrier function and functional loss of pain-mediating fibers, culminate in the central disinhibition of itch among the elderly.[16] Calcium-channel blockers and hydrochlorothiazide may be associated with inflammatory pruritic skin conditions in the elderly.[17,18] Evidence is lacking, however, on the role of other medications as culprits of pruritus in the elderly, making the benefit of discontinuing medications unclear.[15,19] Older individuals are also more likely to have itch driven by age-related immuno-senescence or a shift toward T helper cell type 2-mediated cytokine response.[20–22]

Sex

Gender differences exist in the subjective experience of itch. Women are more likely to present with itch that worsens with psychosomatic factors, neuropathic symptoms, and secondary scratch lesions.[23,24] Men who report itch are older and more likely to have comorbid systemic diseases.[23] Women also experience pruritic disorders that are associated with pregnancy, with approximately 18%−20% of pregnant women experiencing pruritus during gestation.[25,26] For example, intrahepatic cholestasis of pregnancy can cause itch in the second to third trimesters of pregnancy.[27]

Race and ethnicity

Patients who seek ambulatory care for itch are more likely to be African American or Asian.[1] Black patients are more likely to be diagnosed with a variety of pruritic inflammatory skin diseases.[28–34] In addition to genetic and immunologic factors, this

is thought to be due, in part, to the structural properties of black skin, leading to increased transepidermal water loss, decreased ceramide levels, and lower pH in the stratum corneum.[29] Individuals of non-White race were also associated with a more-negative impact of chronic itch on their quality of life, even after adjusting for socioeconomic status.[35] African Americans reported heightened mental distress from chronic itch, with postinflammatory hyperpigmentation from chronic itch as a significant contributor to this negative emotional impact.[36]

The clinical presentation of itch can also vary between racial and ethnic groups. For example, African American patients are more likely to experience more-severe atopic dermatitis than White patients.[29,34] Similarly, itch related to primary biliary cholangitis is more severe among African Americans and Hispanic patients than among Caucasians.[37] Black patients are also at heightened risk of being diagnosed with systemic disorders associated with itch, including end-stage renal disease and HIV-related pruritic dermatoses.[38] In a study of HIV-positive patients at a large tertiary center, African American HIV-positive patients were at increased risk of pruritic disorders compared with White patients.[39]

ETIOLOGIES OF ITCH

Key points

- The common nondermatologic causes of itch include renal, hepatobiliary, oncologic, neuropathic, and psychogeneic etiologies.
- The risk factors that suggest that itch is associated with an underlying malignancy include itch with a duration of less than 12 months, age greater than 60 years, male sex, and history of liver disease and tobacco use.
- HIV-positive patients are at increased risk of experiencing pruritic dermatoses, such as lichen simplex chronicus, prurigo nodularis, and scabies.

Various inflammatory, neoplastic, genetic, infestation or infectious, and autoimmune dermatologic diseases can cause itch (Table I). Approximately 50% of patients with primary diagnoses of dermatologic problems reported pruritus, with 25% reporting severe itch.[40] Itch is also a common symptom associated with numerous nondermatologic conditions and may arise in the context of various systemic, neuropathic, and psychogenic etiologies (Fig 1).

Systemic causes of itch

Renal.—Itch is a common manifestation of advanced chronic kidney disease, with 40%−90% of hemodialysis patients experiencing chronic pruritus.[41–43] The itch with chronic kidney disease is related to uremic neuropathy, systemic inflammation, and increased μ-opioid receptor activity along with decreased κ-opioid activity.[44] Secondary hyperparathyroidism due to chronic kidney disease has also been postulated as a cause of generalized pruritus with an unclear mechanism, suggested by small cohort studies that observed improvement of itch following parathyroidectomy.[45–47]

Hepatobiliary.—Cholestasis from conditions affecting the hepatobiliary system is a common culprit of itch. These include both primary and secondary causes of biliary obstruction that lead to a systemic accumulation of bile acid, including primary biliary cholangitis, primary sclerosing cholangitis, intrahepatic cholestasis of pregnancy, viral hepatitis, and cirrhosis.[48–50] Cholestatic itch arises from a complex interplay between bile acids, lysophosphatidic acid, bilirubin, and increased μ-opioid receptor activity.[49] Recent studies have suggested that bilirubin induces pruritus through the activation of Mas-related G-protein coupled receptor member X4 receptors on sensory neurons.[51] Cholestatic pruritus can be uniquely characterized by the presence of itch that initially affects the palms and soles, becoming more generalized with disease progression.

Endocrine.—Pruritus is more prevalent in diabetic patients than in healthy controls (26.3% vs 14.6%, respectively). Patients with diabetes are predisposed to conditions associated with itch, including superficial mycotic infections, neuropathy, excoriation disorder, and pruritus of the scalp and vulva.[52–55] Itch in diabetes may be secondary to the detrimental effect of increased glucose on cutaneous nerve fibers, representing a sequela of diabetic polyneuropathy. Uncontrolled hyperthyroidism causes itch in a subset of patients, possibly due to reduced itch threshold due to increased body temperature, vasodilation, and kinin activation.[56,57] Hypothyroidism is less frequently associated with itch, but it is associated with xerosis.[57]

Rheumatologic.—Itch is a common symptom of various rheumatologic diseases, due to downstream effects of variable immune activation.[58] Pruritus occurs in approximately half of patients with systemic sclerosis who often have accompanying xerosis.[59] Itch is also a common symptom of dermatomyositis, with 50.8% of patients with dermatomyositis reporting moderate-to-severe itch[60] and itch severity correlating with the degree of skin involvement.[61] The other autoimmune diseases featuring varying degrees of itch include Sjögren syndrome and both cutaneous and systemic lupus erythematosus.[58,62]

Hematologic or oncologic.—Itch can be a prodrome of malignancy, often preceding other signs and symptoms. Although the exact pathophysiology is not known, malignancy-related pruritus may result from a local inflammatory reaction to the tumor or as a paraneoplastic phenomenon. Itch is particularly common in hematologic malignancies,[48] with prevalence estimates as high as 30% among patients with Hodgkin lymphoma,[63] 15% among patients with non-Hodgkin lymphoma,[64] and 67% among patients with polycythemia vera.[65,66] Patients with polycythemia vera often present with aquagenic pruritus, evoked by contact with water of any temperature.[65,66] Other hematologic conditions can also present with generalized pruritus, with eczematous, urticarial, or lichenified skin findings, including hypereosinophilic syndrome, defined as 2 or more separate examinations of absolute eosinophil count $>1.5 \times 10^9$/L in the peripheral blood in the course of 1 month.[67,68]

Itch is also associated with cutaneous lymphomas and other dermatologic cancers.[69–72] Among solid tumors, there is a significant association between itch and cancers of the hepatobiliary system. Although pruritus is thought to be an uncommon symptom in other solid malignancies, there have been case reports of itch occurring in patients with non-

small–cell lung carcinoma,[73] insulinoma,[74] gastric carcinoid tumors,[75] and other solid malignancies.[76,77]

A longitudinal Danish study demonstrated that rates of both hematologic and various solid cancers were higher than expected in patients with pruritus.[78] The incidence ratio of cancers was the most increased compared to the general population within the first 3 months of pruritus diagnosis and remained elevated during the first 12 months. Another study has also suggested that patients with chronic itch but without primary dermatologic findings are at increased risk of an underlying malignancy. This increased risk was especially associated with age older than 60 years, male sex, and history of liver disease and tobacco use.[79] Racial differences have been observed in the association between itch and certain malignancies. Notably, Black pruritic patients may have greater odds of hematologic malignancies, whereas White pruritic patients may be at increased risk of liver and skin malignancies.[69]

Other systemic etiologies.—Itch can occur as an iatrogenic adverse effect of many drugs, suggesting that it is important that physicians across specialties remain vigilant. The common culprits of drug-induced pruritus include immune checkpoint inhibitors[80,81]; agents targeting epidermal growth factor receptor, B-Raf proto-oncogene, cytotoxic T-lymphocyte-associated protein 4, and programmed cell death protein 1/ programmed cell death-ligand 1[82–84]; opioids; and chloroquine and other antimalarials.[85]

Although their exact pathophysiology is yet to be explored, the other potential etiologies of itch may include iron-deficiency anemia, exposure to heavy metal, vitamin deficiency, HIV, and other viral infections. One study found that 13.6% of men and 7.4% of women with iron-deficiency anemia presented with itching, which was significantly increased compared with controls.[86] Elevated blood levels of heavy metals, including cadmium and lead, are also associated with chronic itch.[87] Low levels of vitamin D were observed in patients with chronic pruritic skin conditions, including atopic dermatitis, psoriasis, and chronic urticaria,[88–90] whereas low levels of vitamin B12 were noted in patients with generalized itch from various systemic causes.[91] Oral or topical vitamin supplements had modest positive effects in reducing pruritus in limited studies, although definitive studies are lacking on the association of vitamin deficiencies with the development of chronic itch.[92–95]

Itch is also commonly reported in patients with viral infections, particularly among those with HIV. Pruritus is a significant cause of comorbidity among HIV-positive patients, of whom 13%−45% experience chronic itch.[39,96,97] Many HIV-positive patients have concomitant pruritic disorders, including lichen simplex chronicus, prurigo nodularis, scabies, seborrheic dermatitis, mycosis fungoides, and psoriasis.[39,48,98–100] Patients with advanced HIV are also at risk for eosinophilic folliculitis, an intensely pruritic eruption of follicular papules and pustules in the setting of elevated eosinophils.[98,101]

Neuropathic causes of itch

Itch can arise from neural dysregulation, either from excess stimulation of the peripheral sensory nerves or from the loss of the central inhibition of the itch pathway.[102] Neuropathic pruritus is estimated to comprise 8% of all cases of chronic pruritus.[103] Commonly

recognized causes of neuropathic itch often have distinct dermatomal localizations (Fig 2), but can become generalized.

Brachioradial pruritus most commonly affects middle-aged women of lighter skin types and worsens with exposure to sunlight.[102,104] It typically presents initially with localized itch or a tingling or burning sensation along either proximal upper extremities and shoulders along the C3-C7 dermatomes, often with accompanying degenerative changes noted in the respective cervical spine.[102,105–107] Brachioradial pruritus can become generalized, in a phenomena related to central neural sensitization.[108]

Notalgia paresthetica presents with localized, unilateral pruritus of the area medial to the scapula on the mid-to-upper back. It originates from nerve entrapment of spinal nerves that arise from T2 to T6.[102] Itch localization often correlates with radiologic findings of the vertebrae[109,110] as well as with reduced intraepidermal nerve fiber density in the skin likely as a results of chronic scratching.[109]

Scalp dysesthesia presents with an uncomfortable sensation of the scalp. Although the healthy scalp normally has decreased sensitivity of C-fibers to itch,[111] scalp dysesthesia can result from degenerative changes at C2-C7 levels.[112,113] Similarly, anogenital pruritus is associated with degenerative changes of the lower spine at L4-S2 levels.[114]

The other neurologic conditions associated with itch include trigeminal trophic syndrome, cerebrovascular events, brain infections (eg, encephalitis, Creutzfeldt-Jakob disease), and small fiber neuropathies.[102]

Psychogenic causes of itch

Itch is commonly reported among patients with anxiety and depression, although the pathophysiology still needs further investigation. Itch severity correlates with the level of depressive symptoms.[115] Because of its detrimental effects on sleep and quality of life,[116,117] chronic pruritus leads to increased psychiatric burden of disease[118] and higher odds of suicidal ideation.[11] Itch also is often reported in patients with primary psychodermatologic conditions, including somatic symptom disorder, dermatitis artefacta, obsessive-compulsive disorder, delusional infestation, excoriation disorder, and Morgellons disease. Excoriation disorder is associated with type 2 diabetes mellitus, anxiety, and depression.[55] Chronic itch can be a manifestation of an underlying substance use disorder, including opioids, cocaine, and methylenedioxymethamphetamine.[119]

CLINICAL PRESENTATION, EVALUATION, AND DIAGNOSTIC WORKUP

Key points

- The initial goal of evaluating patients with itch is to determine whether there is primary skin eruption or lesion.
- All patients with chronic itch without primary dermatologic findings should receive a screening laboratory workup consisting of complete blood count with differential, hepatic, renal, and thyroid function testing as well as diabetes

screening, Further testing should be guided by history, review of systems, and findings from the physical examination.

- For individuals with chronic pruritus of unknown origin, increased blood eosinophils is a biomarker of T helper cell type 2 polarization and response to immunomodulator therapy.

Itch can vary drastically in clinical presentation (Fig 3). It can present with inflamed or diseased skin, suggestive of primary dermatologic disorder, or with noninflamed skin, suggestive of a nondermatologic cause.[120] As a caveat, pruritic skin conditions rarely occur without primary skin lesions, as in the case of nonbullous pemphigoid in the elderly or "invisible" mycosis fungoides.[121–123] Secondary scratch lesions (eg, excoriations) can occur with or without primary skin lesions. Itch can be broadly categorized by clinical presentations and underlying etiologies, as presented in Fig 4.

There are several well-validated tools that evaluate itch severity, including the itch numerical rating scale, pruritus grading system, peak pruritus rating scale, worst itch numerical rating scale, and verbal itch rating scale, which are convenient to use in daily practice. Impact on quality of life can also be assessed through the 5D pruritus scale,[124] ItchyQoL,[125] Skindex-29,[126] Patient-Reported Outcomes Measurement Information System Itch Questionnaire,[127] dermatological life quality index, Pittsburgh sleep quality index, Beck Depression Inventory, and hospital anxiety and depression scale, although many of these tools are better suited for clinical trials. In particular, the ItchyQoL has been validated across many European languages[128,129] and is one of the most comprehensive tools to capture multiple domains of itch-related quality of life disruptions.[125]

The first step in evaluating a patient presenting with itch involves determining whether the itch is attributed to a dermatologic cause. This requires a comprehensive history and a thorough physical examination (Table II). Duration of symptoms, episodic nature, severity, and itch localization can provide important clues to the pathogenesis of the itch. For example, nocturnal worsening of itch is observed in most types of itch but may be associated with increased activity of mites at nighttime in patients with scabies. Exogenous triggers or exacerbating factors, such as occupational irritants, water, and heat or sweat, should be identified, as exposure to the indicated triggers can lead to contact dermatitis, aquagenic pruritus, or cholinergic urticaria, respectively. Additional factors that warrant consideration are included in Table II. A thorough assessment of medical history (eg, thyroid, liver, and renal disease; HIV infection; malignancy; psychiatric diagnoses; history of atopy; and/or neck or back pain) and constitutional signs (eg, fevers, chills, night sweats, unintended weight loss, fatigue, heat intolerance) may suggest underlying etiologic factors.

Clinical characteristics of itch offers important clues to the etiology of itch (Fig 5). A thorough skin examination for any primary dermatologic lesion necessitates the identification of a primary lesion (if present) and/or characterization of secondary skin changes due to scratching, rubbing, and picking. Physical manifestations of nondermatologic conditions also should be investigated. Jaundice, ascites, palmar erythema, spider hemangiomas, or gynecomastia, may suggest a hepatobiliary cause; whereas,

lymphadenopathy and signs of cachexia or wasting may point toward an underlying malignancy.

A suggested diagnostic algorithm for the workup of chronic itch is shown in Fig 6. Patients who present with pruritus in the absence of primary dermatologic lesions or eruptions should be screened for nondermatologic causes. The initial tests may include complete blood count with differential, liver function tests, kidney function tests, hemoglobin A1c or fasting glucose, and thyroid function tests. The additional tests to be considered based on a focused history and review of systems include HIV serology, hepatitis serologies, iron studies, and stool ova and parasites. Testing for heavy metal levels and vitamin D or B12 levels in the blood is also a potential consideration. A biopsy with hematoxylin-eosin staining and direct immunoflouresence staining may be considered, even in the absence of primary skin findings, for the elderly patients who may present with nonbullous pemphigoid or “invisible” mycosis fungoides.

Clinicians should consider a workup for occult malignancy based on findings of history, physical examination, and the results of the basic screening laboratory tests. There should be an especially lower threshold for malignancy workup for patients within the first 3 months up to 12 months of pruritus diagnosis,[78] or among those who are not up-to-date with age-appropriate cancer screenings. In this context, a higher index of suspicion should be maintained for hematologic cancers[63–66] and cancers of the hepatobiliary system,[69–71] which are most frequently associated with itch. Such oncologic causes of itch may be ruled out through further imaging and laboratory studies, including chest x-ray, serum protein electrophoresis or urine protein electrophoresis, and ultrasound.

If no specific systemic disease process is identified, patients may be given the diagnosis of chronic pruritus of unknown origin (CPUO). A retrospective study at the Johns Hopkins Itch Center found that the patients with CPUO can be subclassified by the presence or absence of increased number of blood eosinophils (>4%, or >0.30 K/mm^3).[20] Those with increased eosinophils had better therapeutic response to immunomodulatory therapies. Conversely, CPUO patients without increased eosinophils were more likely to have spinal disorder history and have better response to neuromodulator therapies such as gabapentin. Elevated serum immunoglobulin E levels observed in patients with CPUO may also suggest response to immunomodulatory therapies.[21] Although the value of using immunoglobulin E as a therapeutic biomarker in CPUO needs to be explored further, there are reports of dupilumab-associated reduction in immunoglobulin E levels and itch severity in patients with atopic dermatitis.[130] In patients with concurrent history of neck or back pain, additional consideration should be given for neural sensitization as an etiologic factor in their itch.

Conflicts of interest

Dr Kwatra is an advisory board member or consultant for AbbVie, Celldex Therapeutics, Incyte Corporation, Galderma, Pfizer Inc, Regeneron Pharmaceuticals, and Menlo Therapeutics; is an investigator or has received grant funding from Galderma SA, Kiniksa Pharmaceuticals, Pfizer Inc, and Sanofi; is a recipient of a Dermatology Foundation Medical Dermatology Career Development Award and has received grant funding from the Skin of Color Society; and is supported by the National Institute of Arthritis and Musculoskeletal and Skin Diseases of the National Institutes of Health under the award number K23AR077073. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. Authors Roh, Choi, and Sutaria have no conflicts of interest to declare.

Abbreviation used:

CPUO	chronic pruritus of unknown origin

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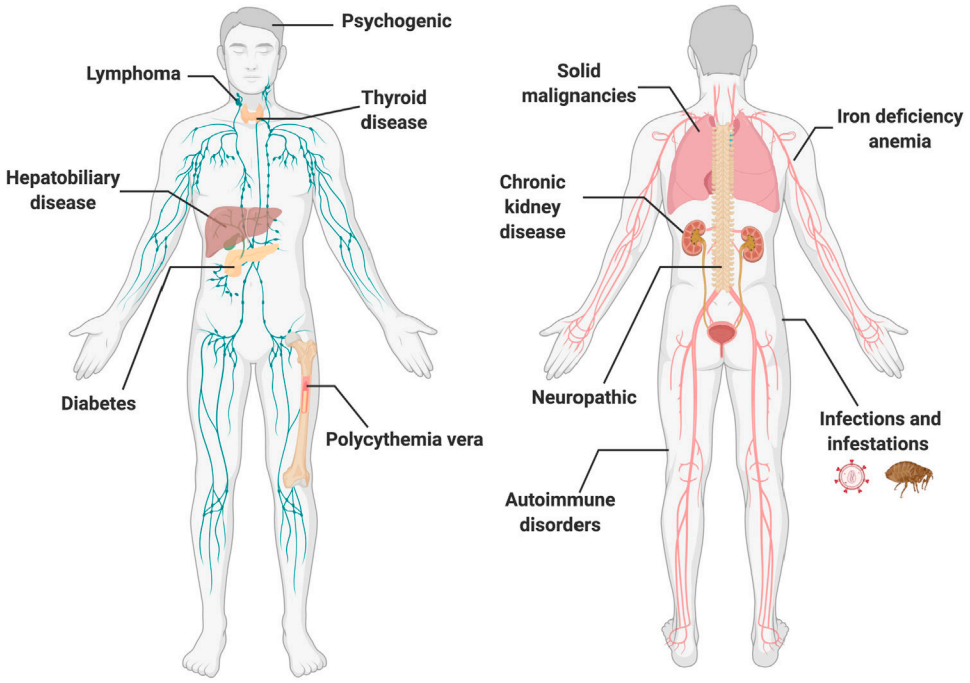


Fig 1.

Itch can arise in the context of various systemic, neuropathic, and psychogenic etiologies.

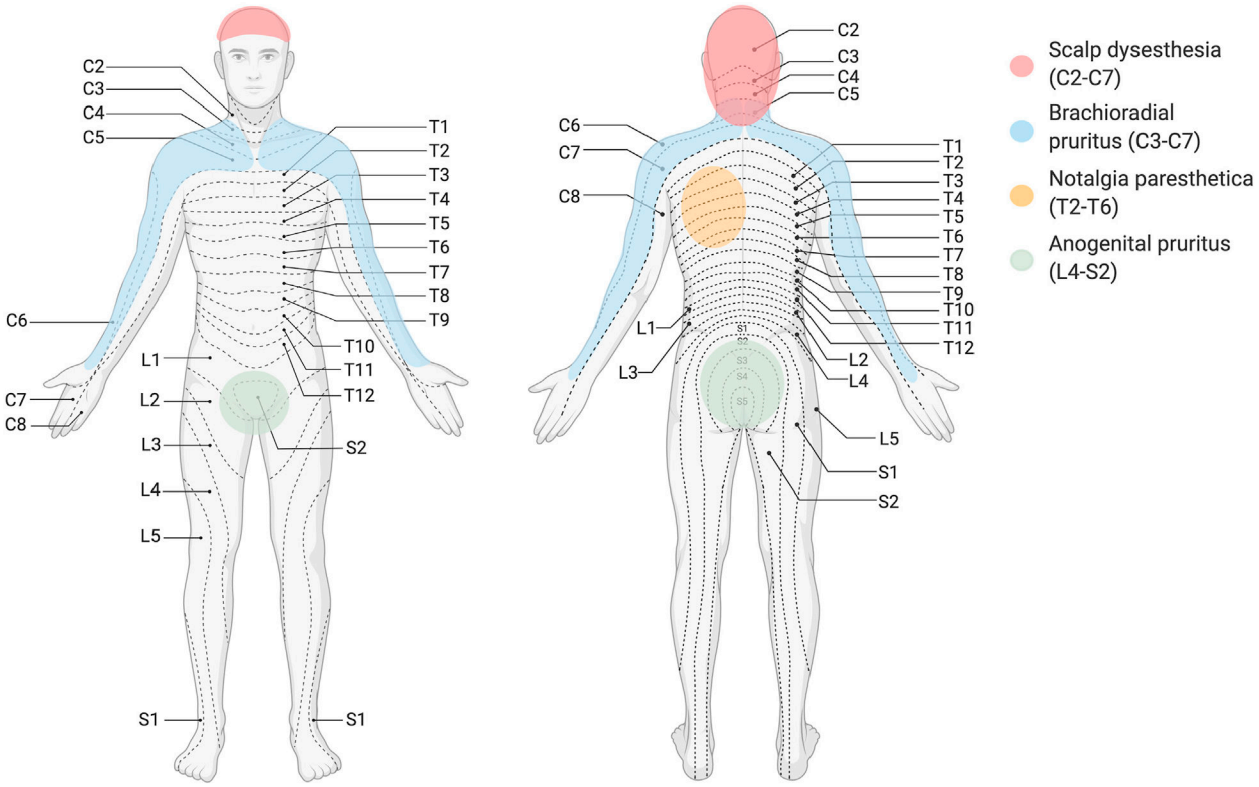
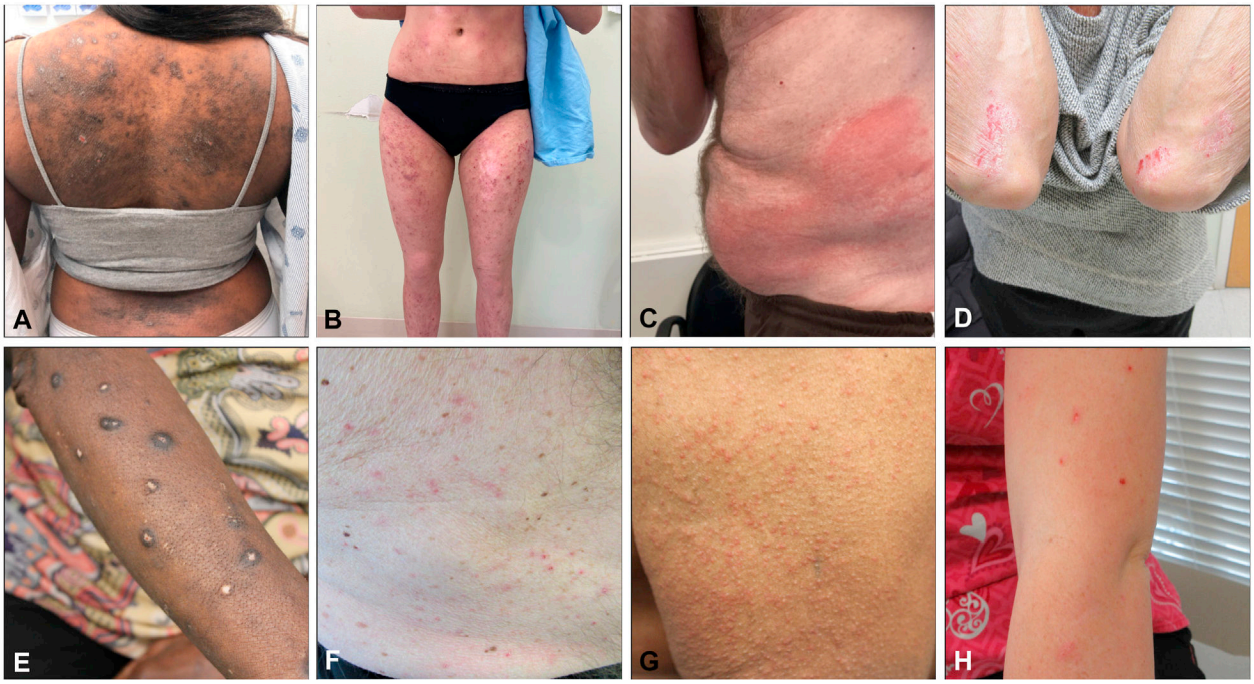


Fig 2.

Neuropathic etiologies of itch. *C*, Cervical; *L*, Lumbar; *T*, Thoracic.



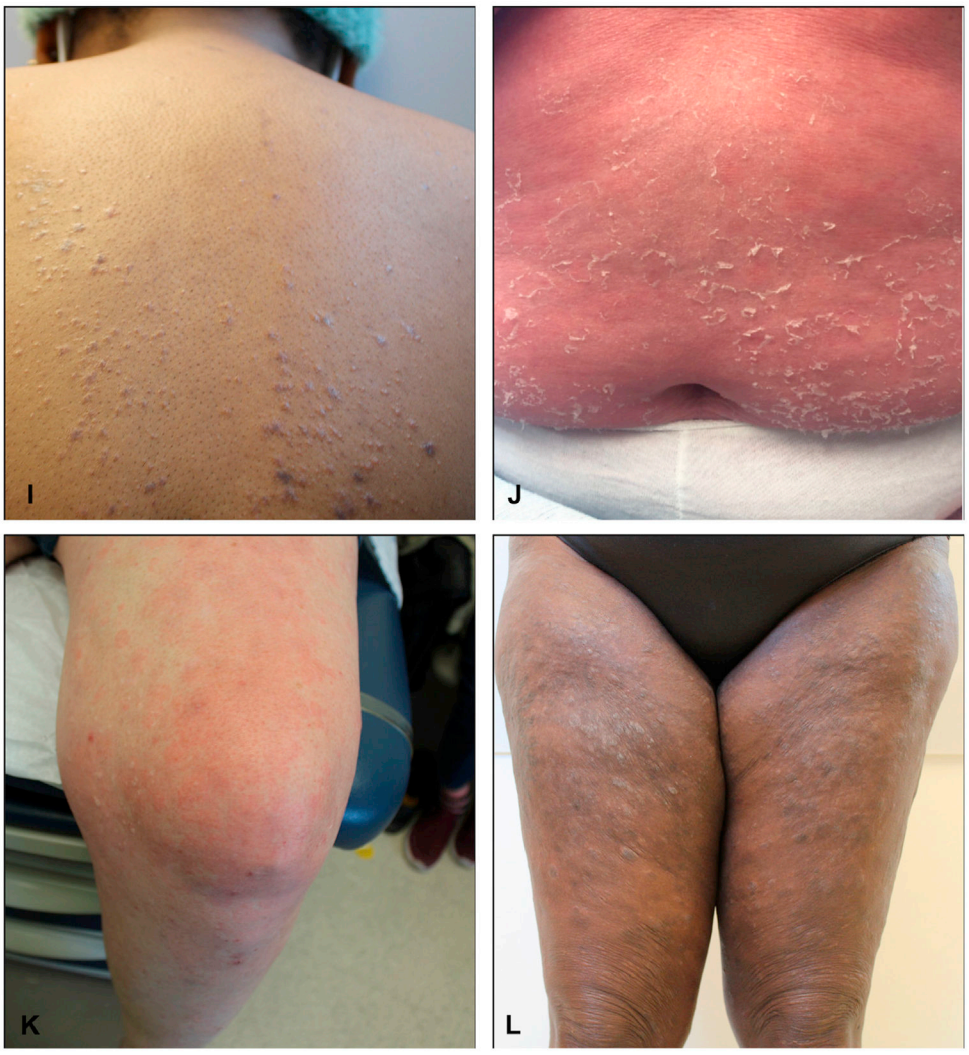


Fig 3.

Various clinical presentations of itch. **A** and **B,** Atopic dermatitis. **C,** Contact dermatitis. **D,** Psoriasis. **E,** Prurigo nodularis. **F,** Grover disease. **G**, Scabies. **H,** Dermal hypersensitivity reaction, often referred to as “itchy red bump disease.” **I,** Lichen planus. **J,** Pityriasis rubra pilaris. **K,** Chronic urticaria. **L,** Mycosis fungoides.

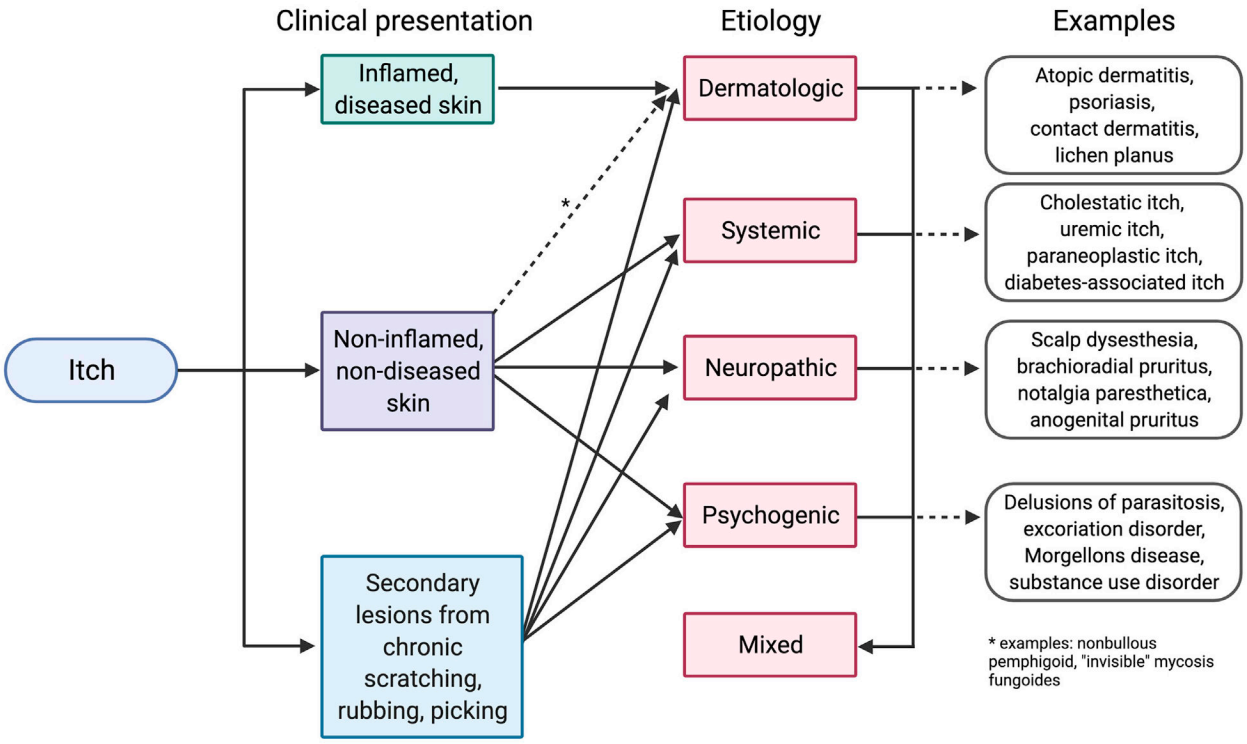


Fig 4.

General approach to itch based on clinical presentation and underlying etiology. These are not absolute categorizations, but represent a general schema.

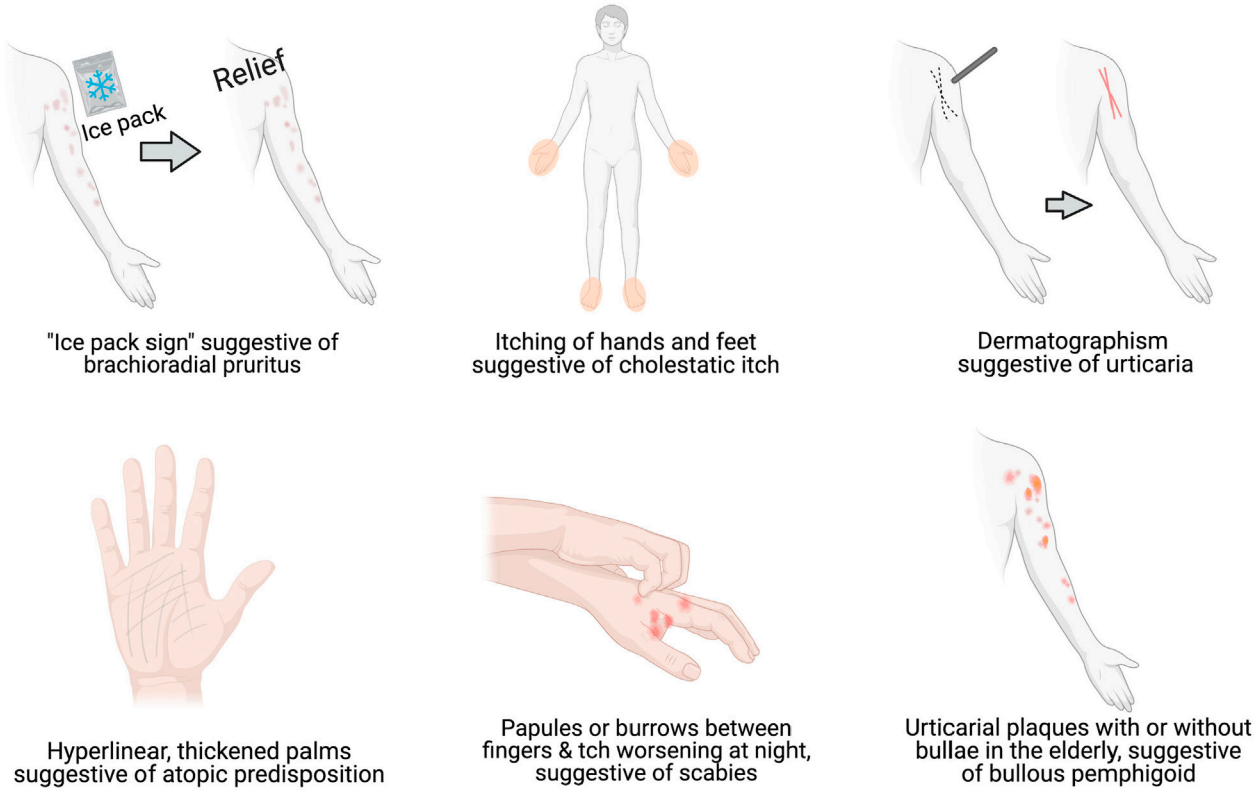


Fig 5.

Bedside clinical clues suggestive of etiologies of itch.

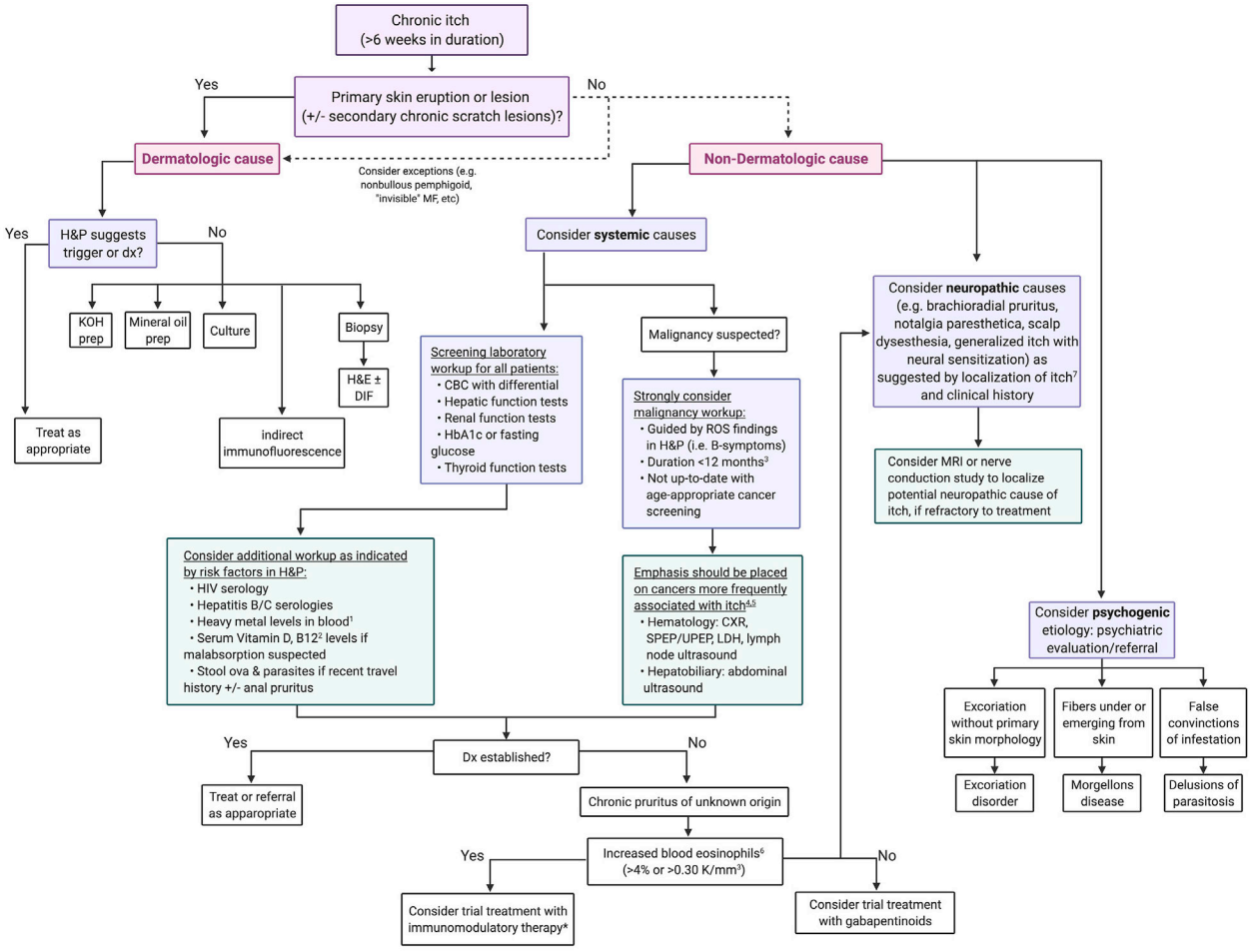


Fig 6.

Diagnostic workup algorithm of chronic itch.[20,69,70,78,87,91,107] *Although the consideration of trial treatment with immunomodulary therapy needs further exploration, patients with elevated IgE may also be responsive to immunodulatory therapy.[130] *CBC*, Complete blood count; *CXR*, chest x-ray; *DIF*, direct immunofluorescence; *Dx*, diagnosis; *H&E*, hematoxylin and eosin; *H&P*, history and physical examination; *HbA1c*, hemoglobin A1c; *KOH*, potassium hydroxide; *LDH*, lactate dehydrogenase; *MRI*, magnetic resonance imaging; *ROS*, review of systems; *SPEP*, serum protein electrophoresis; *UPEP*, urine protein electrophoresis.

Table I.

Examples of dermatologic causes of itch

Types	Examples
Inflammatory	Atopic dermatitis, contact dermatitis, psoriasis, lichen planus, urticaria, pityriasis rubra pilaris, prurigo nodularis, dermal hypersensitivity reaction, Grover disease, granuloma annulare, and primary cutaneous amyloidosis
Infections or infestations	Bacterial, viral, fungal, and parasitic infections (eg, scabies and shistosomal dermatitis)
Neoplastic	Cutaneous T-cell lymphoma and nonmelanoma skin cancer
Autoimmune	Bullous pemphigoid, dermatitis herpetiformis, dermatomyositis, and cutaneous lupus erythematosus
Genetic	Darier disease, Hailey-Hailey disease, epidermolysis bullosa pruriginosa, Sjögren-Larsson syndrome, and porphyria cutanea tarda
Fibrosis-related	Scar-related pruritus, keloids, and sarcoidosis

Table II.

Initial history and physical examination for the assessment of itch

History	Physical examination
Duration	Skin examination
Localization of pruritus	Inflamed skin vs noninflamed skin
Timing and direction	Primary skin lesion
Worsen at night?	Secondary skin lesion (eg, excoriations)
Intermittent? Constant? Worsening?	Examples of other skin examination findings
Triggers	Dermatographism
Environmental exposures	Signs of atopy
Contact with water	Hyperlinear, thickened palms
Heat, exercise, sweating	Infraorbital Dennie-Morgan folds
Household members affected?	Track-like burrows between fingers
Pregnancy status	Erosions and scales between toes
ROS	Stigmata of liver disease
Constitutional B symptoms	Jaundice
Pain, paresthesia, heat intolerance	Ascites
Past medical history	Palmar erythema
History of atopic triad	Gynecomastia
History of neck or back pain	Thyroid examination
Recent medication change	Lymphadenopathy
Allergic history	Cachexia
Social history	Assessment of itch and its burden
Risk factors for communicable disease (HIV, hepatitis C, etc)	Itch NRS
	Scale of 0–10, 0 (“no itch”) and 10 (“the worst imaginable itch”)
Occupational exposure	
Risk factors of malabsorption	WI-NRS for 24 h
History of substance abuse	Scale of 0–10
Travel history	Verbal rating scale of itch on a scale of 0–4
Risk factors for infestation	No itch (0), mild itch (1), moderate itch (2), severe itch (3), very severe itch (4)

NRS, Numeric rating scale; *ROS*, review of systems; *WI-NRS*, worst itch numeric rating scale.