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Janus kinase inhibitors in dermatology: Part II. A comprehensive review

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REVIEW

Janus kinase inhibitors in dermatology: Part II. A comprehensive review

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The Janus kinase-signal transducer and activator of transcription (JAK-STAT) intracellular signaling pathway is implicated in the pathogenesis of a number of inflammatory dermatoses. Clinical trials and other studies have demonstrated the efficacy of JAK inhibitors in the treatment of a variety of dermatologic conditions. Here we review JAK inhibitors currently under investigation for the treatment of alopecia areata, vitiligo, sarcoidosis, necrobiosis lipoidica, granuloma annulare, and systemic lupus erythematosus with a special emphasis on safety and the implications of JAK inhibitors during the novel coronavirus 2019 pandemic. (J Am Acad Dermatol https://doi.org/10.1016/j.jaad.2021.06.873.)

Key words: coronavirus; COVID-19; dermatology; immunology; immunodermatology; JAK inhibitor; Janus kinase inhibitor; Janus kinase-signal transducer and activator of transcription pathway; JAK-STAT pathway; review.

INTRODUCTION

The Janus kinase-signal transducer and activator of transcription (JAK-STAT) pathway is used by a variety of different cytokines for intracellular signaling. There are 4 JAK kinases (JAK1, JAK2, JAK3, and tyrosine kinase 2) that bind directly to the intracellular domain of type I and type II cytokine receptors.[1] Activated JAKs phosphorylate STAT proteins, which dimerize and translocate to the nucleus, where they directly bind DNA and regulate gene transcription (Fig 1).[2] The importance of JAK-STAT mediated intracellular signaling for proper immune function is highlighted by the fact that mutations in JAK3 and tyrosine kinase 2 cause primary immunodeficiency, including severe combined immunodeficiency.[3]

Tofacitinib was the first JAK inhibitor approved in 2012 for the treatment of rheumatoid arthritis in adults.[4] Approval for psoriatic arthritis and ulcerative colitis followed in 2017 and 2018, respectively. Recently, preliminary results from the postmarketing safety clinical trial revealed an increased risk of blood clots, heart-related adverse events, cancer, and death, particularly among patients taking the higher dose of tofacitinib 10 mg twice daily as compared to patients taking a tumor necrosis factor inhibitor. As such, the United States Food and Drug Administration approved a *Boxed Warning* for tofacitinib in 2019.[5]

The scope of use of JAK inhibitors continues to broaden as this class of small molecule inhibitors demonstrated efficacy for the treatment of a variety of dermatologic conditions. In part 1 of this 2-part review series, we discussed JAK inhibitor therapy currently under investigation for the treatment of atopic dermatitis and psoriasis and dermatologic diseases as reported in small studies, including lichen planus, dermatomyositis, and others. Part 2 of this review series is focused on JAK inhibitor therapy currently under investigation for the treatment of alopecia areata (AA), vitiligo, sarcoidosis, necrobiosis lipoidica, granuloma annulare (GA), and systemic lupus erythematosus (SLE), with an emphasis on safety and new developments relating to the use of JAK inhibitors during the novel COVID-19 pandemic.

AA

Loss of hair follicle immune privilege with subsequent activation of autoreactive CD8+ T cells and upregulation of JAK-STAT-dependent inflammatory

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cytokines, including interleukin (IL)-15 and interferon (IFN) γ, have been proposed to explain the nonscarring hair loss seen in AA.[6] A number of case reports, cohort studies, case series, and clinical trials support the use of oral and/or topical JAK inhibitors in AA (Table I).[7-15] Additionally, a number of clinical trials are currently underway to further determine the efficacy of JAK inhibitors in treating AA and other dermatologic conditions (Table II).

Prior to initiating JAK inhibitor therapy, it is recommended to check for latent tuberculosis infection. Specific laboratory monitoring recommendations, dose adjustments, and drug interactions are outlined in the package insert for each JAK inhibitor. For tofacitinib, the recommendation is to check lymphocyte count at baseline and every 3 months thereafter. Neutrophil count, hemoglobin, liver function enzymes, and lipid level should be checked at baseline, approximately 4 to 8 weeks after initiation, and every 3 months thereafter. Dosage adjustments are recommended for patients with hepatic impairment, renal failure, lymphopenia, anemia, neutropenia, and for those taking CYP2C19 and/or CYP3A4 inhibitors, as described in the tofacitinib package insert.[4] Concurrent use of immunosuppressive medications, such as azathioprine, cyclosporine, and tacrolimus, is not recommended, although tofacitinib may be used in combination with nonbiologic disease-modifying antirheumatic drugs, such as methotrexate.[16]

CAPSULE SUMMARY

- Janus kinase inhibitors show immense promise in treating an increasing number of dermatologic conditions discussed here, including alopecia areata, vitiligo, sarcoidosis, necrobiosis lipoidica, granuloma annulare, and systemic lupus erythematosus.
- Janus kinase inhibitors are becoming more important than ever for the dermatologist to have in their treatment armamentarium.

VITILIGO

The pathogenesis of vitiligo involves CD8+ T-cell-mediated destruction of melanocytes. IFN-γ, a JAK-STAT dependent cytokine, and IFN-γ-dependent chemokines, such as CXCL10, also play an important role, suggesting JAK inhibition may be an effective therapeutic strategy.[17] Moreover, when treating vitiligo with JAK inhibitors, concomitant light exposure may enhance the treatment response, as JAK inhibitors are thought to suppress T-cell-mediated melanocyte destruction, while light therapy stimulates melanocyte regeneration.[18] A number of studies have shown promise for the use of JAK inhibitors in the treatment of vitiligo (Table III).[19-24]

GRANULOMATOUS DISORDERS: SARCOIDOSIS, GA, AND NECROBIOSIS LIPOIDICA

Environmental exposure, genetic predisposition, and immunologic mechanisms underly the pathogenesis of sarcoidosis. Sarcoidal granulomas are composed of macrophages and CD4+ T cells that secrete the JAK/STAT-dependent cytokines IL-2 and IFN-γ. The rationale for the use of JAK inhibitors in sarcoidosis was furthered by reports of patients whose cutaneous sarcoidosis resolved and systemic sarcoidosis improved while undergoing treatment with ruxolitinib for hematologic disease.[25,26]

In 2018, Damsky et al[27] reported clearance of cutaneous sarcoidosis with oral tofacitinib 5 mg twice daily in a patient with refractory cutaneous sarcoidosis. Immunohistochemical staining was performed on the patient's skin as well as on archival skin-lesion samples to evaluate for phosphorylated STAT1 (pSTAT1) and pSTAT3 levels in cutaneous sarcoidosis as compared to normal skin. Staining for pSTAT1 and pSTAT3 was significantly higher in lesions of cutaneous sarcoidosis as compared to normal skin. Levels normalized with tofacitinib, supporting the hypothesis that JAK/STAT signaling is implicated in the pathogenesis of sarcoidosis and could be specifically targeted for treatment.[27]

The group subsequently published a report of a patient with a longstanding history of severe cutaneous and systemic sarcoidosis refractory to a multitude of treatments. The patient had clinical resolution of the cutaneous disease after 4 months of tofacitinib therapy, which initially started with 5 mg twice daily for 2 months followed by 10 mg twice daily thereafter. The systemic disease also cleared in this patient. At 6 and 9 months after initiating therapy with tofacitinib, positron emission tomography and computed tomography scans demonstrated that the systemic sarcoidosis had resolved. By abrogating the JAK/STAT signaling pathway, tofacitinib may lead to the improvement of sarcoidosis by altering the levels of key cytokines and factors involved in T-cell and macrophage activation as well as granuloma formation. Damsky et al[28] demonstrated that lesional and plasma levels of IL-2 and tumor necrosis factor α were decreased after treatment with tofacitinib. In

Abbreviations used:

AA:	alopecia areata
GA:	granuloma annulare
IFN:	interferon
IL:	interleukin
JAK:	Janus kinase
JAK-STAT:	Janus kinase-signal transducer and activator of transcription
pSTAT:	phosphorylated STAT
SLE:	systemic lupus erythematosus

another study, they demonstrated normalization of plasma levels of IFN-γ, IFN-α, and IL-6 in a patient with sarcoidosis after treatment with tofacitinib.[29,30]

The pathogenesis of GA has yet to be fully elucidated. It possibly involves a similar mechanism to sarcoidosis, where CD4+ T cells release IFN-γ and other JAK/STAT-dependent cytokines that activate macrophages and lead to cutaneous granuloma formation.[30] There was a report of a patient with generalized GA who experienced complete resolution of cutaneous lesions when on tofacitinib 5 mg twice daily.[30] Another patient had significant improvement with the application of topical tofacitinib 2% ointment twice daily for 15 weeks.[31] While the pathogenesis of GA is poorly understood, pSTAT1 and pSTAT3 staining was elevated in skin samples of GA as compared to normal skin controls and was decreased by oral tofacitinib. Additionally, RNA sequencing on skin biopsy specimens demonstrated a decreased expression of the JAK-STAT-dependent cytokines IFN-γ, IFN-α, and IL-6. Plasma levels of these cytokines were not altered by oral tofacitinib in patients with GA, however.[30]

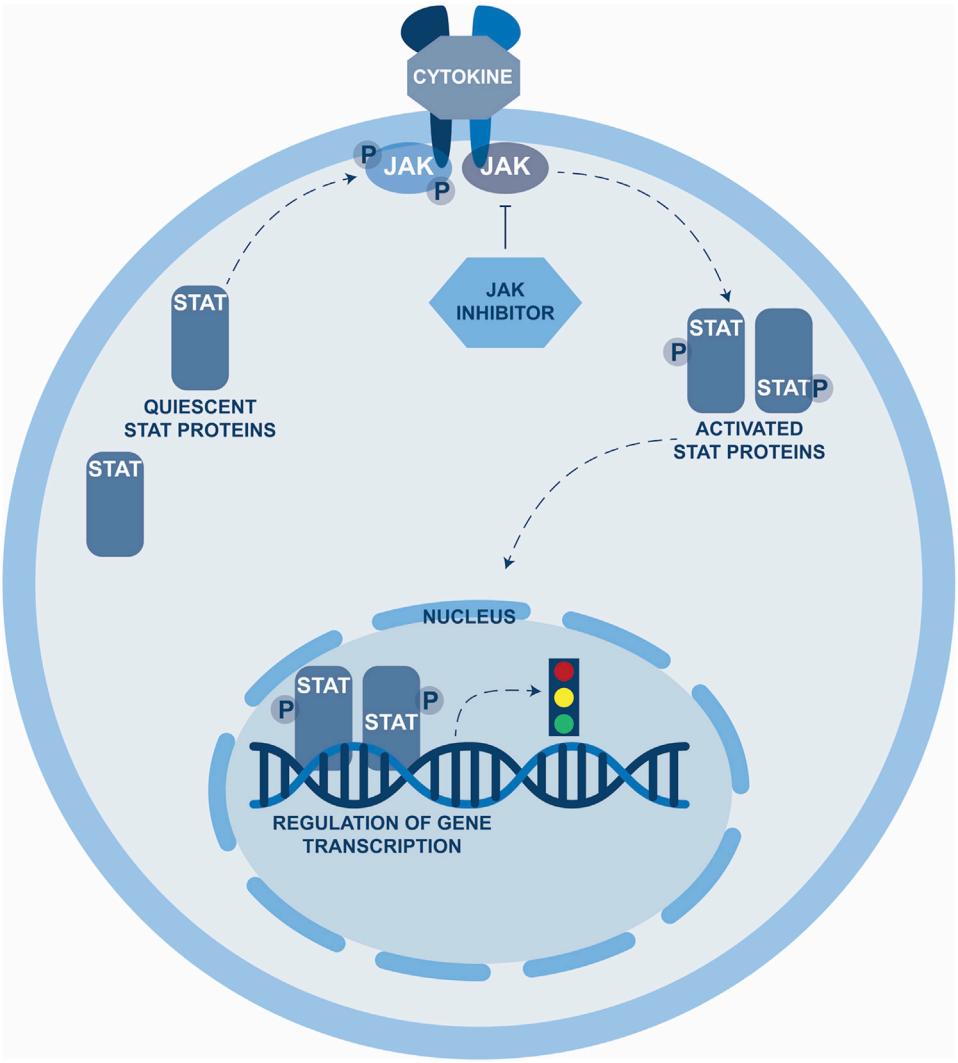

Fig 1. The Janus kinase-signal transducer and activator of transcription (JAK-STAT) signaling pathway. *P*, Phosphorylated.

Table I. JAK inhibitors investigated for the treatment of AA

Dermatologic condition	JAK inhibitor under investigation	Study design	Results	Safety
Alopecia Areata	Oral tofacitinib	Retrospective review of 90 patients[13]	13 patients (20.0%) achieved complete response, 25 patients (38.5%) achieved intermediate response, 12 patients (18.5%) were moderate responders, and 15 patients (23.1%) had no response.*	No serious adverse events were reported. The most commonly reported adverse event was URI (28.9%); 7.8% reported acne, 1 patient developed leukopenia that normalized on treatment, and 1 patient had elevated AST and ALT that normalized on treatment with weight loss.
	Oral ruxolitinib 20 mg daily	Clinical trial of 12 patients with AA[12]	75% responded with at least 50% hair regrowth.	No serious adverse events were reported. The most commonly reported adverse event was URI in 7 of 12 (58%) patients.
	Oral baricitinib 4 mg daily	Case report[11]	Near-complete hair regrowth of scalp, eyebrows, and eyelashes after 4 months of therapy.	No adverse events were reported.
	Oral ruxolitinib	Case report[10]	Nearly complete hair regrowth after 4 months of treatment.	No adverse events were reported. Complete blood count, liver function tests, basic metabolic panel, and lipid panel were checked every 3-4 months without any abnormalities noted.
	Topical tofacitinib and ruxolitinib as well as oral tofacitinib, ruxolitinib, and baricitinib	Systematic review and meta-analysis based on pooled data of 289 patients[14]	72.4% responded to JAK inhibitor therapy (95% CI, 64.5%-79.2%), 45.7% of patients had a good response (95% CI 31.7%-60.3%), and 21.4% had a partial response (95% CI 12.4%-34.4%). Oral JAK inhibitor therapy was significantly associated with response (77.4%) as compared to topical (46.5%), $P = .003$ with an odds ratio of 4.0 (95% CI, 1.56-10.45).	The most commonly reported adverse event was a low-grade infection, 18.2% reported URI, 11.8% developed lipid abnormalities, 1% developed leukopenia, and 1.6% developed transaminitis. No new malignancies were reported.
	Oral and topical tofacitinib	Systematic review and meta-analysis of 252 patients[15]	54.0% achieved > 50% change in SALT score (95% CI, 46.3%-61.5%). Patients taking oral tofacitinib were more likely to achieve > 50% change in SALT score (46.5%; 95% CI, 17.5-78.1) as compared to topical (20.8%; 95% CI, 7.9-44.5) but this was not statistically significant.	The overall pooled rate of adverse events in the clinical trial group was 7.2%, with the highest risk being a URI (56.8%); 13.2% reported acne. In the observational study group, the pooled rate of any adverse event was 22.7%. The rate of headache was 29.1% and the rate of liver enzyme abnormality was 7.7%.

AA, Alopecia areata; *ALT*, alanine aminotransferase; *AST*, aspartate aminotransferase; *CI*, confidence interval; *SALT*, severity of alopecia tool; *URI*, upper respiratory tract infection.
*Complete response (>90% change in SALT score), intermediate response (51%-90% change in SALT score), moderate response (6%-50% change in SALT score), and no response (less than or equal to 5% change in SALT score).

Table II. The ongoing clinic trials for each dermatologic disease discussed in the review as found on ClinicalTrials.gov

Condition	JAK inhibitor	Study phase	ClincalTrials.gov identifier
Alopecia areata	Tofacitinib	Phase 4	NCT03800979
	Ritlecitinib	Phase 2a	NCT04517864
	PF-06651600	Phase 3	NCT04006457
Vitiligo	Topical ruxolitinib 1.5% cream	Phase 3	NCT04057573
	Topical ruxolitinib 1.5% cream	Phase 3	NCT04052425
	Topical ruxolitinib 1.5% cream	Phase 2	NCT03099304
Sarcoidosis and GA	Tofacitinib	Phase 1	NCT03910543
Systemic lupus erythematosus	Elsubrutinib and upadacitinib	Phase 2	NCT03978520
	Elsubrutinib and upadacitinib	Phase 2	NCT04451772

GA, Granuloma annulare; *JAK*, Janus kinase.

Aberrations in pSTAT1 and pSTAT3 may also contribute to disease pathogenesis in necrobiosis lipoidica. There was a recent case report of a patient with recalcitrant and ulcerated necrobiosis lipoidica who had improved wound healing after 6 weeks of tofacitinib 5 mg twice daily combined with intralesional corticosteroid.[32]

SLE

Many of the cytokines implicated in the pathogenesis of SLE, including type 1 IFNs, signal through the JAK/SAT pathway, making this a potential therapeutic target for disease prevention and control. Type 1 IFNs signal through JAK1 and tyrosine kinase 2 to mediate downstream effects, including the production of IFN-α and subsequent activation of dendritic cells. Type 1 IFNs activate dendritic cells and then promote expansion of autoreactive T cells as well as B cell maturation and differentiation into plasma cells, which secrete autoantibodies, thereby contributing to development of autoimmunity and SLE. Moreover, T-cell differentiation into Th17 cells, driven by IL-6, transforming growth factor β, IL-21, and IL-23, is a proposed pathway in the development of autoimmunity and SLE.[33]

In a 2018 double-blind, randomized, placebo-controlled phase II trial assessing the efficacy of oral baricitinib for SLE, patients were randomized to receive placebo, baricitinib 2 mg daily, or baricitinib 4 mg daily.[34] There was a statistically significant difference in the number of patients whose rash and arthritis resolved when taking baricitinib 4 mg daily as compared to placebo (70 of 104 patients [67%]; odds ratio vs placebo 1.8; 95% CI 1.0-3.3; $P = .0414$). Although not statistically significant, patients on baricitinib 4 mg daily had a decreased risk of flare as compared to the placebo group. There was no significant difference in the Cutaneous Lupus Erythematosus Disease Area and Severity Index, extent of skin involvement, anti-double-stranded DNA antibody levels, complement levels, or any other endpoints studied among the groups. No deaths, malignancies, or major adverse cardiovascular events were reported in the study. One patient with antiphospholipid antibodies developed a deep venous thrombosis while on baricitinib 4 mg daily. Herpes zoster occurred in 1 of 105 (1%) of the placebo group and 1 of 104 (1%) of those taking baricitinib 4 mg daily as compared to 0% of those taking baricitinib 2 mg daily. Upper respiratory tract infection was reported in 4 of 105 (3.8%) patients in the placebo group as compared to 10 of 105 (9.5%) in the baricitinib 2 mg daily group and 10 of 104 (9.6%) in the baricitinib 4 mg daily group. There was a statistically significant increase in creatinine phosphokinase and platelet count among those taking baricitinib.[34]

ROLE OF JAK INHIBITORS DURING THE CORONAVIRUS PANDEMIC

There has been much debate regarding the role of JAK inhibitors during the COVID-19 pandemic. Richardson et al[35] suggested that baricitinib may be a potential treatment for SARS-CoV-2 by inhibiting viral endocytosis into lung alveolar cells.[36] Others postulated JAK inhibitors may be used therapeutically to dampen the cytokine-release syndrome responsible for the lung damage induced by SARS-CoV-2 by blocking the activity of inflammatory cytokines, such as IL-2 and IL-6.[37,38] A number of clinical trials are currently ongoing to further study the role of JAK inhibitors in COVID-19 infection and can be found at ClinicalTrials.gov (Table IV).

The question of whether or not patients should continue JAK inhibitor therapy for rheumatologic and dermatologic diseases during the COVID-19 pandemic has also been debated. National and international registries are being compiled to better understand the infection rate and disease course in

Table III. JAK inhibitors investigated for the treatment of vitiligo

Dermatologic condition	JAK inhibitor under investigation	Study design	Results	Safety
Vitiligo	Topical ruxolitinib 1.5% cream twice daily with optional NB-UVB phototherapy	Nonrandomized pilot study of 11 patients[19]	There was a statistically significant improvement in the mean percentage VASI score of 23% (95% CI, 4%-43%; $P = .02$) at week 20 and the best response was seen in facial vitiligo. When the study was extended and included optional NB-UVB phototherapy, there was a statistically significant overall mean improvement in the VASI of 37.6% $\pm$ 31.2% ($P = .011$) from baseline.	No serious adverse events were reported. Transient acne occurred in 2 of 11 patients.
	Topical tofacitinib 2% cream twice daily with either concurrent light therapy, topical corticosteroids, or topical calcineurin inhibitors	Nonrandomized cohort study of 16 patients[20]	4 patients had $>$ 90% repigmentation, 5 patients had 25%-75% repigmentation, 4 patients had 5%-15% repigmentation, 2 patients had no change, and 1 had slow progression. Facial lesions responded better.	One patient developed acne. No other adverse events were reported.
	Oral tofacitinib 5 mg twice daily combined with NB-UVB phototherapy 2 to 3 times weekly	Case report of 2 patients[21]	A 30-year-old Hispanic woman had nearly complete repigmentation of her face and 75% repigmentation of the body. A 50-year-old white man had 50% repigmentation of facial vitiligo at 3 months and 75% at 6 months.	No adverse events. Complete blood count, liver function tests, serum creatinine, and fasting lipid levels demonstrated no abnormalities.
	Oral and topical tofacitinib and ruxolitinib	Systematic review and meta-analysis of 9 studies involving 45 patient cases[22]	57.8% had $>$ 50% repigmentation. There was no statistically significant difference in the proportion of patients achieving $>$ 50% repigmentation among patients using topical JAK inhibitors (75%) as compared to oral (44%), $P = .1$. Patients with facial vitiligo and those who received concurrent phototherapy were more likely to have $>$ 50% repigmentation.	Acne developed in 8.9%, transient elevation of lipids occurred in 8.9%, and URI in 4.4%. No subjects developed new malignancy.
	Topical tofacitinib 2% cream twice daily with NB-UVB phototherapy 3 times weekly	Case report of a 4-year-old boy[23]	Complete repigmentation after 6 months of treatment.	There were no adverse events.
	Topical ruxolitinib cream	Randomized, controlled, phase 2 trial of 157 patients[24]	Patients taking ruxolitinib cream 1.5% twice daily and 1.5% cream once daily were more likely to achieve a 50% or higher improvement from baseline in the F-VASI at 24 weeks (1.5% cream twice daily, 15 of 33 [45%]; OR 24.7; 95% CI, 3.3-1121.4; $P = .0001$); (1.5% cream once daily, 15 of 30 [50%]; OR 28.5; 95% CI, 3.7-1305.2; $P<.0001$) as compared to patients taking lower doses of ruxolitinib cream (0.5% once daily, 8 of 31 [26%]) and placebo (1 of 32 [3%]).	The most common treatment-related adverse events were pruritus at the application site (1.5% cream twice daily, 1 of 33 [3%]); (1.5% cream once daily, 3 of 30 [10%]); (0.5% cream once daily, 3 of 31 [10%]); (vehicle, 3 of 32 [9%]); and acne in 13 of 125 (10%) of patients taking ruxolitinib cream as compared to 1 of 32 (3%) of vehicle. No series treatment-related adverse events were noted and there were no clinically relevant laboratory abnormalities.

CI, Confidence interval; *F-VASI$_{50}$*, 50% or higher improvement from baseline in facial Vitiligo Area Severity Index; *NB-UVB*, narrow-band ultraviolet B; *OR*, odds ratio; *URI*, upper respiratory tract infection; *VASI*, Vitiligo Area Severity Index.

Table IV. Ongoing clinical trials studying the efficacy of JAK inhibitors for the treatment of adult patients with COVID-19 infection

COVID-19 infection	Intervention	Start date	Study phase	ClinicalTrials.gov identifier
Adult patients hospitalized with COVID-19	Baricitinib	November 2020	Phase 3	NCT04640168
COVID-19 pneumonia	Ruxolitinib	October 2020	Phases 1 and 2	NCT04581954
COVID-19 induced ARDS	Ruxolitinib	July 07/2020	Phases 2 and 3	NCT04477993
COVID-19 induced ARDS	Ruxolitinib	June 2020	Phase 3	NCT04424056
COVID-19 pneumonia	Baricitinib	May 2020	Phase 2	NCT04399798
COVID-19 associated ARDS requiring intubation	Ruxolitinib	May 2020	Phase 3	NCT04377620
COVID-19 interstitial pneumonia	Tofacitinib	May 2020	Phase 2	NCT04390061
Treatment of acute lung injury associated with COVID-19	TD-0903 (inhaled pan-JAK inhibitor)	May 2020	Phase 2	NCT04402866
Hospitalized patients with severe COVID-19	Pacritinib	May 2020	Phase 3	NCT04404361
Hospitalized patients with moderate to severe COVID-19 infection	Baricitinib	March 2020	Phase 2	NCT04321993
Hospitalized patients with COVID-19 infection	Ruxolitinib	April 2020	Phases 2 and 3	NCT04348071
Treatment of severe ARDS caused by COVID-19	Ruxolitinib	April 2020	Phases 1 and 2	NCT04334044
Hospitalized patients with COVID-19 infection	Baricitinib	April 2020	Phases 2 and 3	NCT04340232
COVID-19 induced lung injury	Ruxolitinib	April 2020	Phase 2	NCT04359290
COVID-19 pneumonia	Ruxolitinib	April 2020	NA	NCT04331665
COVID-19 pneumonia	Tofacitinib	April 2020	Phase 2	NCT04332042
Symptomatic patients with mild to moderate COVID-19 infection	Baricitinib	March 2020	Phases 2 and 3	NCT04320277

ARDS, Acute respiratory distress syndrome; *JAK*, Janus kinase; *NA*, not available.

patients taking immunosuppressive medications, such as JAK inhibitors.[39]

In April 2020, the American College of Rheumatology generated guidelines for the management of adult patients with rheumatic disease. They recommended JAK inhibitors and other immunosuppressive mediations be continued in patients with ongoing treatment of stable disease in the absence of SARS-CoV-2 infection or exposure. The American College of Rheumatology recommended JAK inhibitor therapy be temporarily stopped in patients who tested positive for COVID-19.[40] In February 2021, the American College of Rheumatology published a COVID-19 vaccine clinical guidance summary, recommending that any modification to immunosuppressive therapy, including JAK inhibitor therapy, around the time of vaccination be determined on a case-by-case basis using shared decision making. In patients with stable disease who are able to tolerate a temporary interruption in therapy, it was recommended that JAK inhibitor therapy be held for 1 week after each vaccine dose in order to maximize vaccine response.[41]

The American Academy of Dermatology also published a set of formal recommendations. The American Academy of Dermatology stated there was insufficient evidence to recommended patients discontinue immunosuppressive medications such as JAK inhibitors during the COVID-19 pandemic. They proposed instead that these decisions be made on a case-by-case basis with a full discussion of risks and benefits. In the event of an active COVID-19 infection, the American Academy of Dermatology recommended holding immunosuppressive medications such as JAK inhibitors until full recovery.[42] The American Academy of Dermatology also advocated following guidelines from the Centers for Disease Control and Prevention regarding COVID-19 vaccination in immunocompromised individuals. The recommendation is that immunocompromised individuals may receive the COVID-19 vaccine if they have no contraindications to vaccination, such as a history of anaphylaxis or an allergic reaction of any severity after a previous dose of the COVID-19 vaccine or a known component of the vaccine.[43]

CONCLUSION AND FUTURE DIRECTIONS

JAK inhibitors exploded onto the scene in dermatology after tofacitinib was first approved for rheumatoid arthritis in 2012. They are currently being studied for the treatment of a variety of dermatologic diseases with no signs of slowing down. Although JAK inhibitors have not been Food and Drug Administration approved for the treatment of any dermatologic disease to date, they have arguably ushered in an exciting frontier in dermatology

therapeutics. For dermatologic diseases that can be notoriously difficult to treat, such as vitiligo and severe AA, no new therapies have been approved by the Food and Drug Administration for years. JAK inhibitors hold immense promise for patients and dermatologists alike.

Conflicts of interest

None disclosed.

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