



Nonstandard and off-label therapies for psoriasis[☆]

Caroline P. Halverstam, MD, Mark Lebwohl, MD*

Department of Dermatology, Mount Sinai School of Medicine, Box 1048, New York, NY 10029-6574, USA

Abstract Although most psoriasis patients respond to standard therapies, many circumstances warrant the use of nonstandard or off-label treatments. For instance, patients with treatment-resistant psoriasis or those who have had multiple adverse effects to other therapies may be good candidates for off-label treatments. Similarly, patients with unusual and hard-to-treat forms of psoriasis such as pustular psoriasis and palmoplantar psoriasis or specific comorbidities may benefit from certain nonstandard therapies. Drugs that may be used as alternatives to standard therapies include mycophenolate mofetil, tacrolimus or pimecrolimus, isotretinoin, colchicine, sulfasalazine, paclitaxel, dapsone, azathioprine, and hydroxyurea. Other unconventional therapies include climatotherapy at the Dead Sea and grenz ray therapy.

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Introduction

In recent years, the armamentarium of psoriasis therapies has become a vast array of topical and systemic treatments. For limited disease, topical corticosteroids, topical vitamin D3 derivatives, topical retinoids, intralesional corticosteroids, and/or the excimer laser are commonly used. More extensive disease is usually treated with light therapy, including broadband ultraviolet B, narrowband ultraviolet B, and psoralen photochemotherapy, or systemic therapy such as acitretin, methotrexate, cyclosporine, and/or an immunobiologic drug (etanercept, infliximab, adalimumab, alefacept, or efalizumab). For the patient whose psoriasis is treatment-resistant or who experiences intolerable adverse effects to multiple thera-

pies, however, alternative therapies must be kept in mind. Nonstandard therapies are also an important consideration in patients with unusual forms of psoriasis or particular comorbidities. For example, for patients with pustular psoriasis, isotretinoin or dapsone may be a good choice. For a patient with comorbid breast cancer, paclitaxel (used in conjunction with an oncologist) might improve the patient's psoriasis in addition to treating his or her malignancy. Azathioprine, alternatively, may be a good choice for a patient with bullous pemphigoid and psoriasis.

Here we present a number of nonstandard or off-label treatments for psoriasis that we have found useful in select patients.

Mycophenolate mofetil

Mycophenolate mofetil is an immunosuppressive drug indicated for prophylaxis of organ rejection in transplant patients. It is the prodrug of mycophenolic acid, which was used for treatment of psoriasis in the 1970s but was associated with a high incidence of gastrointestinal and hematologic adverse effects.

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* Corresponding author.

E-mail address: lebwohl@aol.com (M. Lebwohl).

Mycophenolic acid acts by interfering with T-cell proliferation. It reversibly blocks the de novo synthesis of guanine nucleotides and thus preferentially affects B and T cells, which rely on this de novo synthesis (as opposed to the purine salvage pathway) for DNA and RNA production.

Mycophenolate mofetil has been used successfully in treating inflammatory and autoimmune skin conditions other than psoriasis, including pemphigus vulgaris and bullous pemphigoid.¹ Several reports describe significant improvement in psoriasis patients, although not all patients have a good response.²⁻⁴ Mycophenolate mofetil may be particularly useful in psoriasis patients who are infected with hepatitis C because this drug appears to have antiviral properties, presumably through its anti-DNA and RNA mechanism.⁵

Because the drug is immunosuppressive, patients should be followed for opportunistic infections, lymphoproliferative disorders, and cutaneous and noncutaneous malignancies.⁶ The risk of immunosuppression and malignancy however is based mostly on data in transplant recipients and may in fact be minimal in psoriatic patients.⁷ Patients should be watched for hematologic and gastrointestinal adverse effects, although these also have been minimal in studies of mycophenolate mofetil in psoriasis patients.^{3,4} Suggested monitoring and dosage guidelines are shown in Table 1.^{8,9}

Tacrolimus and pimecrolimus

Oral tacrolimus, previously known as *FK506*, is currently indicated for prophylaxis of organ transplant rejection. It acts by inhibiting calcineurin, which in turn inhibits T-lymphocyte activation. Topical tacrolimus has been shown to be safe and effective in intertriginous and facial psoriasis.^{10,11} For moderate to severe psoriasis, oral tacrolimus reduced

Table 2 Tacrolimus: suggested monitoring and dosage

Baseline monitoring
<ul style="list-style-type: none"> • History and physical examination including blood pressure • Complete blood cell and platelet count • Chemistry screen, including glucose and electrolytes • Creatinine and blood urea nitrogen levels • Pregnancy test • HIV testing, if at risk
Follow-up monitoring
Every 2 to 4 wk, then monthly:
<ul style="list-style-type: none"> • History, physical examination, blood pressure • Complete blood cell and platelet count • Creatinine and blood urea nitrogen levels • Chemistry screen
Dosage
<ul style="list-style-type: none"> • Initial dosage: 0.05 mg/kg daily
Depending on response:
<ul style="list-style-type: none"> • Can be increased to 0.10 mg/kg daily at 3 wk • Can be increased to 0.15 mg/kg daily at 6 wk • Available in 0.5-, 1-, and 5-mg capsules

Modified with permission from Lebwohl and Ali (p 655).⁸

psoriasis area and severity index (PASI) scores by 83% in a randomized placebo-controlled trial.¹² In kidney transplant patients, hypertension, nephrotoxicity, and neurotoxicity are reported adverse effects. This drug is similar in mechanism, efficacy, and safety to cyclosporine; but unlike cyclosporine, it does not cause hypertrichosis.

Another calcineurin inhibitor, pimecrolimus, has also been studied in psoriasis with promising results. Like topical tacrolimus, topical pimecrolimus has been used successfully to treat intertriginous psoriasis.¹³ Oral pimecrolimus has been tested in psoriasis and produces dose-related improvements in PASI score.¹⁴ The only significant adverse event noted in patients receiving pimecrolimus in a randomized trial of psoriasis patients was a transient feeling of warmth. Approval of the drug for psoriasis is not being pursued at this time.

Monitoring and dosage suggestions for tacrolimus are listed in Table 2.⁸

Isotretinoin

Isotretinoin is most frequently used for the treatment of acne, whereas acitretin is generally the retinoid of choice for psoriasis. Etretinate (the prodrug of acitretin) has been shown to control plaque psoriasis more effectively than isotretinoin when used as a single agent.¹⁵ When the retinoids are combined with psoralen photochemotherapy, however, isotretinoin shows equal efficacy in psoriasis as etretinate.¹⁶ Because the half-life elimination of isotretinoin is significantly less than that of acitretin (because of conversion of acitretin to etretinate in vivo), psoralen photochemotherapy with isotretinoin can be an option for women of child-bearing age who do not wish to be on

Table 1 Mycophenolate mofetil: suggested monitoring and dosage

Baseline monitoring
<ul style="list-style-type: none"> • History and physical examination • Complete blood cell count • Chemistry screen • Urinalysis • Pregnancy test
Follow-up monitoring
<ul style="list-style-type: none"> • History and physical examination monthly • Complete blood cell count at wk 1, 2, 3, 4, 6, and 8 and then monthly
Dosage
<ul style="list-style-type: none"> • 500 mg 4 times daily for 12 wk, based on clinical response • Can be increased or reduced by 250 mg daily each month up to a maximum of 4 g daily • Available in 250-mg capsules or 500-mg tablets

Modified with permission from Sherer and Lebwohl.⁹

long-term contraception. Isotretinoin also improves the response of psoriasis to ultraviolet B.

Isotretinoin can also be useful in the treatment of pustular psoriasis.^{15,17} Moy et al successfully treated 10 of 11 patients with pustular psoriasis with isotretinoin. Pustulation usually ceases after 3 to 5 days of treatment with a daily dose of 1.5 to 2 mg/kg.^{17,18} Pustulation often recurs upon reduction of the dose, but subsides when the dose is increased again; thus, one may want to continue therapy with a higher dose of isotretinoin for several weeks. After resolution of the pustulation, most patients require additional agents to control their psoriasis.¹⁵

Guidelines for monitoring patients taking isotretinoin are listed in Table 3.^{8,19} With the introduction of pregnancy prevention programs to monitor use of isotretinoin, use of this medication for psoriasis has become less common.

Colchicine

Colchicine is an old drug extracted from the plant *Colchicum autumnale* and other *Colchicum* species that is most often used to treat symptoms of gout. Its anti-inflammatory actions, including leukocyte suppression and inhibition of cell-mediated immune responses, have made it an intriguing alternative in psoriasis treatment.

The literature on the efficacy of colchicine in psoriasis has been mixed. No large studies have been done on the drug; and whereas some document efficacy in many patients,²⁰ others find the drug to have no effect on skin lesions.²¹ The drug may

Table 4 Colchicine: suggested monitoring and dosage

Baseline monitoring
<ul style="list-style-type: none"> • History and physical examination • Complete blood cell and platelet count • Blood urea nitrogen and creatinine levels • Pregnancy test
Follow-up monitoring
<ul style="list-style-type: none"> • History and physical examination with emphasis on symptoms of neuropathy and myopathy • Complete blood cell and platelet count • Blood urea nitrogen and creatinine levels
Dosage
<ul style="list-style-type: none"> • 0.6-1.2 mg/kg once to twice daily • Available as 0.6-mg tablets

Monitoring recommendations based on published data.²⁷

be more useful in recalcitrant or difficult-to-treat forms of psoriasis such as pustular psoriasis and palmoplantar psoriasis. Zachariae et al reported 3 of 4 patients treated with colchicine for pustular psoriasis to have a complete remission of the disease.²² Colchicine has also been reported to be successful with palmoplantar psoriasis,^{23,24} but other reports have contradicted these results.²⁵ Although the literature is sparse and sometimes conflicting in these areas as well, the pustular and palmoplantar forms of psoriasis often require multiple attempts at treatment with different therapies, making colchicine a valid consideration in hard-to-treat patients.

Gastrointestinal adverse effects are common and can occur in up to 80% of patients at high doses (above 2-3 mg/d); they can be a useful marker of toxicity.²⁶ Patients on long-term therapy should be monitored for myopathy and neuropathy, and overdose of the drug can cause pancytopenia and renal failure. Colchicine dosages varied in studies, but generally can be given at 0.6 to 1.2 mg once to twice daily. Monitoring and dosage guidelines are described in Table 4.²⁷

Sulfasalazine

Sulfasalazine is usually used to treat Crohn's disease, ulcerative colitis, and, occasionally, rheumatoid arthritis. The mechanism of action is unknown, but its efficacy as an anti-inflammatory agent may be due to interference with folate metabolism by inhibiting dihydrofolate reductase and inhibiting folate absorption.²⁸ In a double-blind, randomized, controlled trial of sulfasalazine in psoriasis, 82% of patients had a moderate to marked improvement in their psoriasis.²⁹

Sulfasalazine has also been reported to improve psoriatic arthritis.^{30,31} The improvement may however be only marginal.^{31,32} In a large, double-blind, placebo-controlled trial, 58% of patients treated with 2 g daily of sulfasalazine showed improvement in their psoriatic arthritis compared with 45% of those taking placebo.³¹ This benefit must be weighed against the adverse effects of the drug, which are common.

Table 3 Isotretinoin: suggested monitoring and dosage

Baseline monitoring
<ul style="list-style-type: none"> • History and physical examination • Pregnancy test and registration in iPledge system • Complete blood cell and platelet count • Liver function tests • Blood urea nitrogen and creatinine levels • Cholesterol, high-density lipoprotein, and triglyceride levels • Urinalysis
Follow-up monitoring
Monthly
<ul style="list-style-type: none"> • History and physical examination • Pregnancy test and follow-up in iPledge system
At 2 wk, then monthly for 4 to 6 mo, then every 3 mo
<ul style="list-style-type: none"> • Liver function tests • Cholesterol and triglyceride levels
Monthly, then every 3 mo
<ul style="list-style-type: none"> • Complete blood cell and platelet count, • Blood urea nitrogen and creatinine levels • Urinalysis
Dosage
<ul style="list-style-type: none"> • 0.5-2 mg/kg daily

Modified with permission from Tan et al.¹⁹ Monitoring recommendations also based on authors' experience.

Adverse effects with sulfasalazine are generally not serious but occur in up to 60% of patients and have caused up to 15% of patients to withdraw from trials.³² Most adverse effects are due to high serum concentrations of sulfapyridine and poor acetylation of the drug. They include gastrointestinal intolerance (nausea, heartburn, vomiting, and diarrhea), malaise, headache, arthralgia, drug fever, and reversible male infertility (due to oligospermia).³³ More serious adverse effects include leukopenia and agranulocytosis. Skin eruptions can also occur and caused 4 of 23 patients receiving drug to drop out of one trial.²⁹

Sulfasalazine should be started at a low dose, such as 0.5 g 3 times daily, and increased as tolerated. Dosage and monitoring suggestions are summarized in Table 5.^{8,29}

Climatotherapy at the Dead Sea

Climatotherapy involves daily bathing in Dead Sea water and graduated exposure to sunlight, usually beginning at about 15 minutes daily and increasing to a maximum of 3 hours daily, depending on skin type. Treatment is usually for 4 weeks. It has been hailed as one of the most effective treatments in psoriasis, with decreases in PASI scores by 75% or more and remission of the disease commonly occurring for several months.³⁴⁻³⁶ Shani et al found climatotherapy to be one of the most cost-effective treatments for psoriasis—cheaper than inpatient treatment and with the added benefit of being a nondrug and nonstressful alternative to other psoriasis therapies.³⁶ This analysis took into account the cost of flight, hotel accommodations, medical costs, laboratory tests, loss of productivity during a 4-week treatment, adverse effects, and remission time; however, the authors included only

European patients, and flight cost would likely be higher for American patients.

Adverse effects of treatment are generally few but can include sunburn, pruritus, folliculitis, and solar damage such as elastosis, solar lentigines, poikiloderma, and facial wrinkles.^{35,37} There is also a theoretical risk of photodamage, nonmelanoma skin cancer, and possibly malignant melanoma.

Most of the benefit of climatotherapy at the Dead Sea has been attributed to the sunlight at the Dead Sea. At more than 300 m below sea level, it is the lowest point on earth. Thus, sunlight passes through 300 m of a mineral haze that filters out short wavelengths of ultraviolet B.

Balneophototherapy, which involves salt water baths and artificial ultraviolet radiation, can be used as an alternative to climatotherapy at the Dead Sea and has reported high clearance rates.^{38,39}

Paclitaxel

Paclitaxel is a chemotherapeutic agent usually used for breast and ovarian cancers that has antiproliferative, antiangiogenic, and anti-inflammatory effects. Because of the observation that several cancer patients treated with the drug showed improvement in concomitant psoriasis, Ehrlich et al undertook a pilot study to test the drug in patients with severe psoriasis.⁴⁰ In the study of 12 patients, there was a decrease in PASI scores by 15% to 80%. Patients who received a higher dose of drug (75 mg/m² every 4 weeks for a total of 6 infusions) tended to have more dramatic results than patients who received a lower dose at more frequent intervals (37.5 mg/m² every 2 weeks for 3 infusions, then 50 mg/m² for an additional 6 infusions), but also had an exacerbation of their disease at weeks 3 and 4 after the infusion. For this reason, the authors suggest a dosage of 75 mg/m² every 2 weeks in psoriasis patients. Three patients dropped out of the study because of adverse events (2 hypersensitivity reactions and a Crohn's disease flare).

No myelosuppression was observed, and it generally does not occur until doses of ≥ 100 mg/m² every 3 weeks are reached.⁴⁰ Hypersensitivity reactions are common among cancer patients, but the use of micellar paclitaxel (used in this study) may cause fewer infusion reactions than other forms of the drug. Oral derivatives of paclitaxel are now being studied in cancer patients and may prove to be of benefit in psoriasis without the drawback of hypersensitivity reactions.⁴⁰ Monitoring and dosage guidelines are outlined in Table 6.^{40,41}

Dapsone

Dapsone is an antileprosy drug that has anti-inflammatory properties and is approved for treatment of dermatitis

Table 5 Sulfasalazine: suggested monitoring and dosage

Baseline monitoring

- History and physical examination
- Complete blood cell and platelet count
- Chemistry screen
- Urinalysis

Follow-up monitoring

Every 2 wk for 3 mo, every month for 3 mo, then every 3 mo or as clinically indicated

- History and physical examination
- Complete blood cell and platelet count
- Chemistry screen
- Urinalysis

Dosage

- Initial dosage, 0.5 g 3 times daily
- If tolerated, increase dose to 1 g 3 times daily after 3 d
- If tolerated, increase dose to 1 g 4 times daily after 6 wk
- Efficacy, or lack thereof, should be apparent by 4 to 6 wk
- Available as 500-mg tablets and enteric-coated tablets

Modified with permission from Lebwohl and Ali (p 657).⁸

Table 6 Paclitaxel: suggested monitoring and dosage

Baseline monitoring
<ul style="list-style-type: none"> • History and physical examination • Complete blood cell and platelet counts • Chemistry screen • Electrocardiogram • Pregnancy test
Follow-up monitoring
At each infusion
<ul style="list-style-type: none"> • History and physical examination • Complete blood cell and platelet counts • Chemistry screen
Dosage
<ul style="list-style-type: none"> • 75 mg/m² every 2 wk • Premedication with 50 mg diphenhydramine at each infusion
Monitoring recommendations based on published data ⁴⁰ and package insert. ⁴¹

herpetiformis. The use of dapsone in psoriasis was first reported by MacMillan and Champion in a case of a 47-year-old man with treatment-resistant generalized pustular psoriasis.⁴² The patient's condition was eventually controlled on a regimen of long-term dapsone and systemic triamcinolone. Since then, dapsone has also been used to successfully treat several cases of childhood pustular psoriasis.⁴³⁻⁴⁵ Juanqin et al reported an excellent response in 19 of 26 children and a moderate response in an additional 5 children when treated with dapsone (1 mg/kg daily) combined with triptolide (the active ingredient in a Chinese herb) and erythromycin.⁴⁴

The antiinflammatory effects of dapsone are several and include interference with neutrophil chemotaxis, blockage of prostaglandin- and leukotriene-mediated inflammation, and inhibition of myeloperoxidase in neutrophils and eosinophils, preventing tissue injury from oxygen radicals.⁴⁶

The most common adverse effect of dapsone is dose-related methemoglobinemia and hemolysis. Most patients experience a decrease in hemoglobin, but hemolysis is most dramatic in patients with G6PD deficiency.⁴⁶ Agranulocytosis can also occur, but is rare. The Food and Drug Administration Dermatology Advisory Committee recommends that complete blood counts be done weekly for the first month, monthly for 6 months, and semiannually thereafter.⁴⁷ Periodic neurologic screening for peripheral neuropathy should also be done, although this adverse effect is rare.⁴⁶

The recommended dosing of dapsone in dermatitis herpetiformis is a starting dose of 50 mg daily, with appropriate titrating up to 300 mg daily, although higher doses may be tried if the disease is still not controlled. Dosage should be reduced to a lower maintenance dose if possible. The dosage for pustular psoriasis in children is generally 1 mg/kg daily. Dosage and monitoring are summarized in Table 7.^{47,48}

Azathioprine

Azathioprine is an analogue of the physiologic purines (eg, adenine, guanine) and has immunosuppressive activity. It is approved for use in renal transplant recipients and for rheumatoid arthritis. Azathioprine is converted to 6-mercaptopurine in vivo and then further converted to its active form, the nucleotide thioinosinic acid. Azathioprine is known to inhibit mitosis, suppress antibody formation, and diminish T-cell responses.

Several studies have shown the efficacy of azathioprine in severe psoriasis. The largest study reported that 19 of 29 patients with psoriasis benefited from azathioprine, with 13 of those 19 patients exhibiting 75% to 100% clearance of their disease.⁴⁹ Another study of mostly treatment-resistant patients showed 5 of 10 patients with a 25% or greater improvement in their psoriasis after azathioprine therapy.⁵⁰

Case reports have indicated that azathioprine may be a good choice for patients with concurrent bullous pemphigoid and psoriasis^{51,52} because azathioprine is an effective therapy for bullous pemphigoid and withdrawal from corticosteroids (the standard therapy for bullous pemphigoid) can cause a psoriatic flare.⁵³

The main adverse effects of azathioprine are seen in tissues characterized by rapid cell division. Bone marrow toxicity can cause leukopenia, anemia, thrombocytopenia, or pancytopenia. Patients with an inherited deficiency in thiopurine *S*-methyltransferase activity may have an increased risk of developing myelotoxicity and should therefore be screened with thiopurine *S*-methyltransferase genotyping or phenotyping. Liver toxicity manifested in elevations in serum transaminases, alkaline phosphatase, and bilirubin can occur, although this is uncommon in non-

Table 7 Dapsone: suggested monitoring and dosage

Baseline monitoring
<ul style="list-style-type: none"> • History and physical examination • G6PD level • Complete blood cell and platelet count • Liver function tests and total bilirubin • Pregnancy test
Follow-up monitoring
<ul style="list-style-type: none"> • Monthly history and physical examination with emphasis on symptoms of jaundice indicating hemolysis • Complete blood cell and platelet counts weekly for 4 wk, monthly for 6 mo, and then every 6 mo • Liver function tests and total bilirubin
Dosage
<ul style="list-style-type: none"> • Initial dose, 50 mg daily • Can increase as tolerated to 300 mg daily or higher if necessary • 1 mg/kg in children • Available as 25- and 100-mg tablets
Monitoring recommendations based on published data ⁴⁷ and package insert. ⁴⁸

Table 8 Azathioprine: suggested monitoring and dosage

Baseline monitoring
<ul style="list-style-type: none"> • History and physical examination • Thiopurine <i>S</i>-methyltransferase genotyping or phenotyping • Complete blood cell and platelet count • Chemistry screen • Liver function tests and total bilirubin • Pregnancy test
Follow-up monitoring
<ul style="list-style-type: none"> • History and physical examination monthly • Complete blood cell and platelet counts weekly for 1 mo, then every 2 wk for 2 mo, then monthly or more often if dosage alterations or other therapy changes are made • Chemistry screen • Liver function tests and total bilirubin
Dosage
<ul style="list-style-type: none"> • 1.5-3 mg/kg daily • Available as 25 and 100 mg tablets
Monitoring recommendations based on published data ^{53,54} and package insert. ⁵⁵

transplant patients.⁵⁴ Possible gastrointestinal symptoms include nausea, vomiting, diarrhea, and, less commonly, oral ulcerations, esophagitis, and steatorrhea.⁵⁵

Because of its severe adverse effects, azathioprine should generally be reserved for psoriatic patients who have failed multiple other therapies. Patients should be monitored for hematologic and hepatic abnormalities, and regular liver biopsies should be considered. The recommended dosage of azathioprine in dermatologic disease is 150 mg daily or less. Dosage and monitoring suggestions are shown in [Table 8](#).⁵³⁻⁵⁵

Hydroxyurea

Hydroxyurea is an antimetabolite generally used in cancer patients or patients with hematologic conditions. It has been a known treatment of psoriasis for more than 30 years and likely works by inhibiting DNA replication in the basal layer of the skin, thus reducing cell turnover. In a recent study of 31 patients (most with recalcitrant psoriasis), 75% showed at least a 35% reduction in PASI score and more than half had more than a 70% reduction in PASI score.⁵⁶ The drug however may be slower acting than many other available therapies for psoriasis, with maximum response occurring at around 6 to 8 weeks after the start of therapy.^{56,57}

In a crossover trial in which 13 patients with palmoplantar psoriasis were given either hydroxyurea or placebo for 3 weeks each, there was no significant improvement in pustules, redness, or scaling in patients treated with hydroxyurea.⁵⁸ The 3-week treatment period, however, may have been too short to see improvement because the drug appears to be relatively slow acting, as seen in the plaque psoriasis trial above.

Recent evidence has shown a role for hydroxyurea in reducing viral loads in HIV-infected patients (in combination with antiretroviral therapy).^{59,60} Although no studies have been done with hydroxyurea in HIV-infected patients with psoriasis, this drug may be ideal for such patients.

The major adverse effect of hydroxyurea is bone marrow toxicity causing leukopenia, anemia, thrombocytopenia, or, less commonly, pancytopenia. Most patients display at least mild laboratory abnormalities, and about one third require dose adjustment.⁵⁷ Blood counts should be taken weekly for at least the first 4 weeks of treatment and then taken less frequently if appropriate.⁵⁷ Liver and renal toxicity is also reported, but rare; in fact, hydroxyurea may be considered in patients with liver disease for whom methotrexate is not an option. Notably, some patients experience mild changes in skin pigmentation or, rarely, diffuse alopecia; these effects are dose-dependent and reversible with discontinuation of the drug.^{56,57}

Hydroxyurea is usually dosed at 1 to 1.5 g daily. [Table 9](#) lists dosing and monitoring guidelines.

Grenz ray therapy

Grenz rays are essentially short-wavelength X rays with a wavelength of 0.07 to 0.4 nm, which is also in the range of long-wavelength ultraviolet radiation. *Grenz* means *border* in German, reflecting the idea that these rays might resemble conventional X rays in some respects and ultraviolet rays in others. Grenz ray therapy has been shown to be effective at treating scalp psoriasis in a double-blind bilateral trial where 14 of 16 patients showed

Table 9 Hydroxyurea: suggested monitoring and dosage

Baseline monitoring
<ul style="list-style-type: none"> • History and physical examination • Complete blood cell and platelet count • Chemistry screen • Liver function tests • Pregnancy test
Follow-up monitoring
<ul style="list-style-type: none"> • History and physical examination monthly • Complete blood cell and platelet counts weekly for 4 wk, then every 2-4 wk for at least 12 wk • Chemistry screen every 3 mo • Liver function tests every 3 mo
Dosage
<ul style="list-style-type: none"> • 1-1.5 g daily • Can be increased up to 2 g daily. After dosage increases, repeat weekly blood cell count monitoring • Hold dosage if white blood cell count $<2.5 \times 10^9/L$, if platelet count is $<100 \times 10^9/L$, or if severe anemia occurs • Available in 500-mg capsules

Modified with permission from Lebwohl and Ali (p 657).⁸ Monitoring recommendations also based on published data.⁵⁷

complete healing of the area of their scalp treated with grenz rays.⁶¹ Nine of these patients remained symptom-free in the treated area for 3 months. It has also been shown that grenz rays combined with topical corticosteroids clear scalp psoriasis faster than topical corticosteroids alone,⁶² although corticosteroids do not appear to significantly improve the results of the grenz ray therapy.⁶³

There is also some evidence to support the use of grenz ray therapy in palmoplantar psoriasis and psoriatic nails.^{64,65} The therapy however appears to be useful only as an adjunct to other therapies for palmoplantar psoriasis and may only work in psoriatic nails of normal thickness.

The mechanism of action of grenz rays is mostly unknown, although it is known that the number of Langerhans cells decreases in the epidermis after treatment.⁶⁶

The major adverse effects of grenz ray therapy are erythema and pigmentation. Nonmelanoma skin cancers have also been reported, but this risk is small. In a retrospective study of 14,140 patients who received grenz ray treatments for benign skin disorders, 39 patients developed nonmelanoma skin malignancies (compared with an expected 26.9); and only 8 patients had received grenz ray treatment at the site of the tumor.⁶⁷ The same study showed no excess risk of malignant melanomas in patients who received grenz ray therapy.

The dose used in most studies was 4 Gy of grenz rays given weekly for 6 weeks.

In summary, nonstandard and off-label therapies for psoriasis can provide effective control of the disease and may be the ideal remedy in select patients where other therapies have failed or where comorbidities introduce unique therapeutic challenges. Such treatments thus present an important alternative to more widely used therapies.

Drug names

acitretin: Soriatane
 adalimumab: Humira
 alefacept: Amevive
 cyclosporine: Neoral
 efalizumab: Raptiva
 etanercept: Enbrel
 infliximab: Remicade
 mycophenolate mofetil: Cellcept
 pimecrolimus (topical): Elidel
 tacrolimus (oral): Prograf
 tacrolimus (topical): Protopic

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