

Commentary and update: Methotrexate for psoriasis—two decades later

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As a resident in dermatology at the Cleveland Clinic 20 years ago, I wished to pursue a research project that would have clinical application, and I became interested in studying methotrexate (MTX), a dramatic systemic drug useful in treating psoriasis.

Control of severe generalized psoriasis with systemic drugs has long been a goal of dermatologists. Drugs initially used such as arsenic and systemic corticosteroids had resulted in serious adverse reactions and are generally not used today. Systemic corticosteroids often produced generalized pustular psoriasis. Antimetabolic drugs ushered in a new era in the treatment of psoriasis. Gubner et al¹ fortuitously noted in 1951 the rapid clearing of psoriatic skin lesions in a patient with rheumatoid arthritis treated with aminopterin. Clinical experience in dermatology developed with aminopterin²; however, it was later replaced by a more stable derivative, MTX,³ which was used in cyclic dosages with fewer severe side effects than aminopterin. Other antimetabolic drugs such as hydroxyurea, azathioprine, azaribine, and mycophenolic acid have been used to treat psoriasis, but have not been as effective as methotrexate, which has stood the test of time despite many side effects. Recently, psoralen and UVA (PUVA) therapy and systemic retinoids have challenged MTX as the best systemic treatment for psoriasis.

The mechanism of action of MTX was well worked out when we initiated our studies with MTX.⁴ We found in experimental studies of animals that a single dose of MTX was safer than divided doses. The common practice at that time

was two or three tablets of MTX administered daily for five days and then resting a few days and repeating the dose. We proposed giving MTX as a single oral dose, 25 mg/wk.

Methotrexate was a cancer chemotherapy drug and for the first years (1955–1970) was the standard systemic drug for the treatment of psoriasis, although it was not approved by the Food and Drug Administration (FDA). Under the Psoriasis Task Force of the National Program for Dermatology, Roenigk, Maibach, and Weinstein^{5,6} prepared guidelines for MTX treatment of psoriasis after a thorough review of the literature. Soon after these guidelines were developed the FDA used them to approve MTX for use in psoriasis. The MTX guidelines were recently revised after 10 years of experience.⁷ The following represents the major points of these guidelines in the use of MTX as a systemic treatment for psoriasis.

Indications

The decision to administer MTX for the treatment of psoriasis should be made on an individual basis with regard to severity, amount of discomfort, degree of incapacity, and general medical and psychological condition. Methotrexate is indicated in the symptomatic control of recalcitrant psoriasis not responsive to topical therapy. The diagnosis of psoriasis and the need for MTX therapy should be established by dermatologic consultation.

Only patients who have severe psoriasis, which may be life-ruining physically, emotionally, or economically and cannot be adequately controlled by standard topical antipsoriatic therapy should be treated with MTX. Some examples of candidates for MTX therapy are listed in the *Table*.⁷

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Table. Methotrexate guidelines

Candidates for MTX therapy
Psoriatic erythroderma
Psoriatic arthritis
Acute pustular psoriasis—Von Zumbusch type
Localized pustular psoriasis
Psoriasis in areas of body preventing economic employment
Extensive psoriasis
Relative contraindications
Significant renal function abnormalities
Significant liver function abnormalities
Pregnancy—near absolute
Men or women in fertile age—appropriate steps should be taken to avoid conception during and for at least 12 weeks after discontinuing MTX therapy
Hepatitis, active or recent
Cirrhosis
Severe anemia, leukopenia, or thrombocytopenia
Peptic ulcer, active—near absolute
Excessive alcohol consumption
Active infectious diseases (i.e., tuberculosis, pyelonephritis)
Unreliable patient. Circumstances may arise in which contraindications must be waived, i.e., when benefits can be expected to outweigh the risks of MTX therapy in an individual patient
Pre-MTX evaluation
History and physical examination
Laboratory
1. Hematologic
Hemoglobin
Leukocyte count
Platelet count (quantitative)
2. Renal function studies
Urinalysis
Blood urea nitrogen (BUN)
Serum creatinine or creatinine clearance
3. Liver function studies
Routine liver function tests, such as serum glutamic pyruvic transaminase (SGPT), serum glutamic oxaloacetic transaminase (SGOT), alkaline phosphatase, bilirubin
4. X-ray film of chest
Liver biopsy
Continuing laboratory studies
1. 1- to 4-week intervals
Leukocyte count
Platelet count
2. 3- to 4-month intervals
Hemoglobin
Urinalysis
Serum creatinine
SGPT
SGOT
Alkaline phosphatase
3. Yearly intervals
Creatinine clearance (optional)
Chest x-ray

A thorough history and physical examination often identify patients with preexisting risk factors such as liver disease. Chemical liver function tests identify only certain cases of existing liver disease. Recent studies⁸ with quadratic multiple

ordered laboratory tests have differentiated between alcoholics and nonalcoholics with different degrees of liver disease. Our initial studies⁴ had identified several patients with abnormal liver function, which encouraged further studies⁹ to investigate abnormalities of liver biopsies in patients before starting MTX (*Table*).⁷

The liver and methotrexate

After many years it became apparent that some patients were showing abnormal liver function study results while receiving MTX. Early studies immediately incriminated MTX although no pretreatment liver biopsies had been done and other factors such as alcohol, drugs, and hepatitis were not considered.¹⁰ Dermatologists began doing biopsies on psoriatics with no prior MTX therapy and found a variety of abnormalities including cirrhosis.^{9,11} It has been suggested that the liver was involved in the pathogenesis of psoriasis. In the late 1960s several pretreatment liver biopsies were done prospectively to determine the effects of MTX on the liver. An international meeting was held to develop criteria for classifying liver biopsies and to evaluate the data of many investigators on MTX and liver function. Weinstein et al¹² found no increase in incidence of fibrosis and cirrhosis from first to last liver biopsy. Factors found to be important in increasing liver damage due to MTX were (1) obesity, (2) increased age, (3) alcohol intake, (4) total dose of MTX, (5) frequency of administration (daily oral dosage schedule). These studies formed the basis of recommendations on follow-up of liver function studies and biopsies in the MTX Guidelines.⁵⁻⁷

Liver scans are of minimal value in detecting liver disease. The most reliable test of liver damage is the needle biopsy technique. Severe liver disease can be present, as shown by liver biopsy, in the face of a normal physical examination, liver function tests, and liver scans.

Therefore, it is advisable that a liver biopsy be done, when feasible, before starting MTX therapy. Exceptions might be: (1) advanced age, (2) marked obesity, (3) acute illness (acute pustular psoriasis), (4) medical contraindications for liver biopsy (cardiac instability, prolonged bleeding time for prothrombin time), and (5) anticipated short-term use of MTX. When these conditions change³⁻⁵ and long-term use of MTX is anticipated, liver biopsy should be done.

The decision regarding follow-up liver biopsies during MTX therapy is made on the basis of

pretreatment liver biopsy, risk factors, and total cumulative dose of MTX. Details of management are outlined in the recent guidelines.⁷

The international cooperative study¹² published in 1973 involved 550 patients, and 81 patients had pre-MTX and post-MTX sequential liver biopsies. The second study involved 900 patients two years later. Both concluded that with increased dosage of MTX (>2200 mg), there was no significant increase in incidence of cirrhosis, but an overall slight increase in liver damage. Evaluation of single post-MTX liver biopsies showed a 3% incidence of cirrhosis.

Zachariae et al¹³ and Nyfors and colleagues^{14,15} suggest that longer exposure (years) to MTX and/or a higher cumulative dose of MTX leads to a higher incidence of cirrhosis. The international cooperative study¹² shows a much lower incidence of cirrhosis than Nyfors¹⁴ (2 groups, 1977) and Zachariae.¹⁶ All studies indicate that the incidence of cirrhosis is low with a total dose of MTX below 1.5 g.

Risk factors (alcohol, arsenic, lowered renal function, obesity, diabetes) in Zachariae's¹⁶ (1980), and probably in all studies, increase the risk of fibrosis and cirrhosis developing with accumulation of less than 1.5 g of MTX. Nyfors¹⁴ (1977) has the highest reported cumulative MTX dose (4000 mg) in a large group and suggests an increasing incidence of cirrhosis with cumulative increased dosage. It is our impression that the incidence of cirrhosis in the United States is much lower than recently reported (Nyfors and Zachariae), particularly when the risk factors can be minimized.

Klaber and Baker¹⁷ have recently confirmed reports of Nyfors and Zachariae of a high incidence of fibrosis and cirrhosis after many years of MTX therapy in total cumulative dose over 5000 mg. The clinical course of cirrhosis induced by MTX seems to be nonaggressive; in fact many of these patients have been continued on MTX therapy without worsening of liver biopsy findings.¹⁷

Drug dosage schedules

The single oral dose that we suggested in our initial studies⁴ has remained one of the two major forms of administration. Weinstein and Frost¹⁸ did kinetic studies that confirmed a mechanism of action of MTX in psoriasis. They suggested a divided dose, intermittent oral schedule given over a 36-hour period each week. Although one liver biopsy study¹⁹ suggested increased toxicity

from this schedule, it is still used along with the single oral dose.

Drug interactions

The use of any drug in addition to MTX should be carefully evaluated and avoided, unless there are definite indications for its use.

Methotrexate is bound in part to plasma albumin and is displaced by a number of other drugs.⁷ Toxicity may be altered by concomitant use of these drugs. In the dosages of MTX used in treating psoriasis, such reactions are rarely clinically significant. Concomitant therapy with irradiation or with chemical agents known to have a depressive effect on the hematopoietic system should be used with extreme caution. Corticosteroids administered systemically with MTX should be avoided when possible. The concomitant use of corticoids and MTX increases the risk of serious complications.

Adverse reactions

Other reactions to MTX noted in our early studies were nausea, headaches, and burning of the skin, and later included gastrointestinal, hematological, urogenital, and central nervous system problems.

Several single case reports of carcinoma developing during MTX therapy have been published, implicating possible immunosuppressive effects of MTX. Bailin et al¹⁹ followed 205 MTX-treated psoriatics, but observed no increase in the incidence of internal cancer, neither general nor specific. Nyfors²⁰ followed 248 MTX-treated psoriatics and found 10 malignancies, again of different types and not significantly higher than the expected number of internal malignancies. Stern et al²¹ found no increase in cutaneous or noncutaneous malignancies in MTX-treated patients.

Combination therapy

Although combinations of MTX with other drugs may produce adverse drug interaction, some drug combinations with MTX may have beneficial effects and reduce potential toxicity from both drugs. Topical therapy should be encouraged to keep the dose of MTX low. Patients taking MTX tend to abandon effective topical and intralesional steroids and tars; patients whose disease is *not* controlled by MTX would benefit from the full Goeckerman.

Methotrexate combined with PUVA resulted in clearing at a considerably lower amount of

UVA than is noted with PUVA alone.²² Patients have been treated with a three-week course of MTX followed by a combination of UVB and MTX.²³ Methotrexate was stopped when the disease was controlled and maintenance was with UVB therapy alone. It is difficult and inconvenient to control severe psoriasis with UVB alone without having to restart MTX. The well-known recall of UVB-induced erythema²⁴ was not seen in this study.

Methotrexate combined with retinoids provides a more rapid clearing of severe generalized pustular psoriasis than either drug alone.^{25,26} Further experience with these two drugs and possibly combining them with UVB or PUVA may reduce the adverse reactions of each modality by allowing rest and repair of the various organ systems targeted for toxicity during treatment with an alternative agent.

References

- Gubner R, August S, Ginsberg V. Therapeutic suppression of tissue reactivity; effect of aminopterin in rheumatoid arthritis and psoriasis. *Am J Med Sci* 1951; **221**:176-182.
- Rees RB, Bennett JH, Bostick WL. Aminopterin for psoriasis. *AMA Arch Dermatol* 1955; **72**:133-143.
- Edmundson WF, Guy WB. Treatment of psoriasis with folic acid antagonists. *AMA Arch Dermatol* 1958; **78**:200-203.
- Roeningk HH Jr, Haserick JR, Curtis GH. Methotrexate for psoriasis; a preliminary report. *Cleve Clin Q* 1965; **32**:211-215.
- Roeningk HH Jr, Maibach HI, Weinstein G. Use of methotrexate in psoriasis. *Arch Dermatol* 1972; **105**:363-365.
- Roeningk HH Jr, Maibach HI, Weinstein G. Psoriasis-liver-methotrexate interactions. *Arch Dermatol* 1973; **108**:36-42.
- Roeningk HH Jr, Auerbach R, Maibach HI, Weinstein GD. Methotrexate guidelines; revised. *J Am Acad Dermatol* 1982; **6**:145-155.
- Ryback RS, Eckardt MJ, Felsher B, Rawlings RR. Biochemical and hematologic correlates of alcoholism and liver disease. *JAMA* 1982; **248**:2261-2265.
- Roeningk HH Jr, Bergfeld WF, St. Jacques R, Owens FJ, Hawk WA. Hepatotoxicity of methotrexate in the treatment of psoriasis. *Arch Dermatol* 1971; **103**:250-261.
- Coe RO, Bull FE. Cirrhosis associated with methotrexate treatment of psoriasis. *JAMA* 1968; **206**:1515-1520.
- Shapiro HA, Trowbridge JO, Lee JC, Maibach HI. Liver disease in psoriatics; an effect of methotrexate therapy? *Arch Dermatol* 1974; **110**:547-551.
- Weinstein G, Roeningk H, Maibach H, Cosmides J, Halprin K, Millard M. Psoriasis-liver-methotrexate interactions. *Arch Dermatol* 1973; **103**:36-42.
- Zachariae H, Grunnet E, Sogaard H. Liver biopsy in methotrexate-treated psoriatics; a re-evaluation. *Acta Derm Venereol* 1975; **55**:291-296.
- Nyfors A. Liver biopsies from psoriatics related to methotrexate therapy. 3. Findings in post-methotrexate liver biopsies from 160 psoriatics. *Acta Pathol Microbiol Scand A* 1977; **85**:511-518.
- Nyfors A, Hopwood D. Liver ultrastructure in psoriatics related to methotrexate therapy. 1. A prospective study of findings in hepatocytes from 24 patients before and after methotrexate treatment. *Acta Pathol Microbiol Scand A* 1977; **85**:787-800.
- Zachariae H, Kragballe K, Sogaard H. Methotrexate induced liver cirrhosis. *Br J Dermatol* 1980; **102**:407-412.
- Klaber MR, Baker H, Courtauld E, Levene GM. Prospective study of liver biopsies in patients with psoriasis receiving methotrexate therapy. *Br J Dermatol* 1982; **107**:28.
- Weinstein GD, Frost P. Abnormal cell proliferation in psoriasis. *J Invest Dermatol* 1968; **50**:254-259.
- Bailin PL, Tindall JP, Roeningk HH Jr, Hogan MD. Is methotrexate therapy for psoriasis carcinogenic? A modified retrospective-prospective analysis. *JAMA* 1975; **232**:359-362.
- Nyfors A. Benefits and adverse drug experiences during long-term methotrexate treatments of 248 psoriatics. *Dan Med Bull* 1978; **25**:208-211.
- Stern RS, Zierler S, Parrish JA. Methotrexate used for psoriasis and the risk of noncutaneous or cutaneous malignancy. *Cancer* 1982; **50**:869-872.
- Morison WL, Momtaz K, Parrish JA, Fitzpatrick TB. Combined methotrexate; PUVA therapy in the treatment of psoriasis. *J Am Acad Dermatol* 1982; **6**:46-51.
- Paul BS, Khosrow M-T, Stern RS, Arndt KA, Parrish JA. Combined methotrexate-ultraviolet B therapy in the treatment of psoriasis. *J Am Acad Dermatol* 1982; **7**:758-762.
- Moller H. Methotrexate and ultraviolet light inflammation in the guinea pig. *Dermatologica* 1970; **140**:225-230.
- Vanderveen EE, Ellis CN, Campbell JP, Case PC, Voorhees JJ. Methotrexate and etretinate as concurrent therapies in severe psoriasis. *Arch Dermatol* 1982; **118**:660-662.
- Rosenbaum M, Roeningk HH Jr. Methotrexate and etretinate in the treatment of psoriasis. *J Am Acad Dermatol* (in press)