

NEW ZEALAND DATA SHEET - METHOBLASTIN®

WARNINGS

Methotrexate must be used only by physicians experienced in antimetabolite chemotherapy, or in the case of non-oncological conditions, by a specialist physician.

Because of the possibility of fatal or severe toxic reactions, the patient should be fully informed by the physician of the risks involved and should be under his constant supervision.

Deaths have been reported with the use of methotrexate.

In the treatment of psoriasis, methotrexate should be restricted to severe, recalcitrant, disabling disease which is not adequately responsive to other forms of therapy, but only when the diagnosis has been established by biopsy and/or after appropriate consultation.

Potential of fatal toxicity from dosing errors

Both the physician and the pharmacist should emphasise to the patient the importance of the weekly dosing regimen: mistaken daily use may cause serious and sometimes life-threatening or fatal toxicity (see section 4.2 and 4.4, 4.9). For the same reason great care should be taken with dispensing to ensure the correct tablet strength of Methoblastin is given to the patient. Methoblastin is available as 2.5 mg and 10 mg tablets.

Organ system toxicity

Gastrointestinal

Diarrhoea and ulcerative stomatitis are frequent toxic effects and require interruption of therapy; otherwise, haemorrhage enteritis and death from intestinal perforation may occur.

Gastrointestinal toxicity has been reported with concomitant administration of methotrexate (usually in high doses) along with nonsteroidal anti-inflammatory agents (NSAIDs).

Haematological

Methotrexate may produce marked depression of bone marrow, anaemia, aplastic anaemia, leucopenia, neutropenia, thrombocytopenia and bleeding.

Unexpectedly severe (sometimes fatal) marrow suppression and aplastic anaemia have been reported with concomitant administration of methotrexate (usually in high doses) along with NSAIDs.

Hepatic

Methotrexate may be hepatotoxic, particularly at high dosage or with prolonged therapy. Liver atrophy, necrosis, cirrhosis, fatty changes and periportal fibrosis have been reported. Since changes may occur without previous signs of gastrointestinal or haematological toxicity, it is imperative that hepatic function be determined prior to initiation of treatment and monitored regularly throughout therapy. Special caution is indicated in the presence of pre-existing liver

damage or impaired hepatic function. Concomitant use of other drugs with hepatotoxic potential (including alcohol) should be avoided.

Musculoskeletal

Methotrexate given concomitantly with radiotherapy may increase the risk of soft tissue necrosis and osteonecrosis.

Infection or Immunologic States Potentially fatal opportunistic infections, especially *Pneumocystis jirovecii* pneumonia, may occur with methotrexate therapy.

Immunisation

Vaccination with a live vaccine in patients receiving chemotherapeutic agents may result in severe and fatal infections.

Pulmonary

Methotrexate-induced lung disease including acute or chronic interstitial pneumonitis and pleural effusion is a potentially dangerous lesion, which may occur acutely at any time during therapy and which has been reported at low doses. It is not always fully reversible and fatalities have been reported. Pulmonary symptoms (especially a dry, non-productive cough) may require interruption of treatment and careful investigation. Pulmonary lesions can occur at all dosages. Infections (including pneumonia) needs to be excluded. Patients should be closely monitored for pulmonary symptoms.

Renal

Impaired renal function is usually a contraindication.

Malignant lymphomas

Malignant lymphomas, which may regress following withdrawal of methotrexate, may occur in patients receiving low-dose methotrexate and, thus, may not require cytotoxic treatment. Discontinue methotrexate first and, if the lymphoma does not regress, appropriate treatment should be instituted.

Fetal toxicity

Use in Pregnancy

Pregnancy category D

Methotrexate has caused fetal death and/or congenital abnormalities. Therefore, it is not recommended in women of childbearing potential unless there is appropriate medical evidence that the benefits can be expected to outweigh the considered risks. Pregnant psoriatic patients should not receive methotrexate. Women of childbearing potential should not be started on methotrexate until pregnancy is excluded and should be fully counselled on the serious risk to the fetus should they become pregnant while undergoing treatment.

Pregnancy should be avoided if either partner is receiving methotrexate, during and after cessation of therapy. Reliable contraception is recommended during and for at least three months after end of the treatment for males. For females, reliable contraception is

recommended during and for at least six months after end of the treatment. The optimal time interval between the cessation of methotrexate treatment of either partner, and pregnancy, has not been clearly established.

Use in lactation

Women should be advised not to breastfeed while being treated with methotrexate.

Use in children

Aside from its established use in cancer chemotherapy; the safety and efficacy of using methotrexate in children has not been fully elucidated.

1. PRODUCT NAME

Methoblastin[®] 2.5 mg, 10 mg tablets

2. QUALITATIVE AND QUANTITATIVE COMPOSITION

Each 2.5 mg tablet contains 2.5 mg methotrexate.

Each 10 mg tablet contains 10 mg methotrexate.

Excipient(s) with known effect

Each 2.5 mg tablet contains 39.9 mg lactose monohydrate.

Each 10 mg tablet contains 36.6 mg lactose monohydrate.

For the full list of excipients, see section 6.1.

3. PHARMACEUTICAL FORM

2.5 mg tablet: Yellow, round, convex tablet engraved with “M 2.5” on one side and blank on the other.

10 mg tablet: Yellow, capsule shaped tablet engraved with “M10” on the same side as the score line.

4. CLINICAL PARTICULARS

4.1 Therapeutic indications

Antineoplastic chemotherapy

Treatment of breast cancer, gestational choriocarcinoma, and in patients with chorioadenoma destruens and hydatidiform mole. Palliation of acute and subacute lymphocytic leukaemia. Greatest effect has been observed in palliation of acute lymphoblastic (stem cell) leukaemias. In combination with corticosteroids, Methoblastin may be used for induction of remission. The drug is now most commonly used for the maintenance of induced remissions. Methoblastin is also effective in the treatment of the advanced states (III and IV, Peters Staging System) of lymphosarcoma, particularly in children and in advanced cases of mycosis fungoides.

Psoriasis chemotherapy

See WARNINGS box and section 4.4. Because of the high risk attending to its use, Methoblastin is only indicated in the symptomatic control of severe, recalcitrant disabling psoriasis which is not adequately responsive to other forms of therapy, but only when the diagnosis has been established, as by biopsy and/or after dermatologic consultations.

4.2 Dose and method of administration

Dose

Methotrexate should only be prescribed by physicians with expertise in the use of methotrexate and full understanding of the risks of methotrexate therapy.

The prescriber should ensure that patients or their carers will be able to comply with the once weekly regimen.

Important warning about the dosage of Methotrexate

In the treatment of psoriasis, Methotrexate must only be used once a week. Dosage errors in the use of Methotrexate can result in serious adverse reactions, including death. Please read this section of the Product Information very carefully.

Weekly dosage prescriptions should specify a particular day of the week.

Prescribers should advise the patient of the dosing regimen for their awareness and obtain at least a verbal indication from the patient that they have understood the dosing regimen.

Pharmacists should clearly indicate the dosing regimen on the dispensing label at the point of dispensing and obtain at least a verbal indication from the patient that they have understood the dosing regimen.

Antineoplastic chemotherapy

Breast carcinoma

Prolonged cyclic combination chemotherapy with cyclophosphamide, methotrexate and fluorouracil has given good results when used as adjuvant treatment to radical mastectomy in primary breast cancer with positive axillary lymph nodes.

Choriocarcinoma and similar trophoblastic diseases

Methoblastin is administered orally in doses of 15-30 mg daily for a five day course. Such courses are usually repeated three to five times as required with a rest period of one or more weeks interposed between courses, until any manifesting toxic symptoms subside.

The effectiveness of therapy is ordinarily evaluated by 24 hour quantitative analysis of urinary chorionic gonadotropin hormone (CGH), which should return to normal or less than 50 units/24 hour usually after the 3rd or 4th course and usually be followed by a complete resolution of measurable lesions in 4 to 6 weeks.

One to two courses of methotrexate after normalisation of CGH is usually recommended. Before each course of the drug, careful clinical assessment is essential.

Cyclic combination therapy of methotrexate with other antitumour drugs has been reported as being useful. Since hydatidiform mole may precede or be followed by choriocarcinoma, prophylactic chemotherapy with methotrexate has been recommended. Chorioadenoma destruens is considered to be an invasive form of hydatidiform mole. Methoblastin is administered in these disease states in doses similar to those recommended for choriocarcinoma.

Leukaemia

Methoblastin alone or in combination with steroids was used initially for induction of remission of lymphoblastic leukaemias. When used for induction, in doses of 3.3 mg/m² in combination with prednisone 60 mg/m² given daily, remission occurred in 50% of patients treated, usually within a period of 4 to 6 weeks.

Methoblastin alone, or in combination with other agents appears to be the drug of choice for securing maintenance of drug induced remissions. When remission is achieved and supportive care has produced general clinical improvement, maintenance therapy is initiated, as follows: Methoblastin is administered in doses of 30 mg/m² twice weekly.

If and when relapse does occur, reinduction of remission can again usually be obtained by repeating the initial induction regimen.

Lymphomas

In Burkitt's tumour, stages I-II, Methoblastin has produced prolonged remission in some cases. Recommended dosage is 10 to 25 mg per day orally for 4 to 8 days.

In stage III, Methoblastin is commonly given concomitantly with other antitumour agents. Lymphosarcomas in stage III may respond to combined drug therapy with Methoblastin given in doses of 0.625 mg to 2.5 mg/kg daily.

Treatment in all stages usually consists of several courses of the drug interposed with 7 to 10 day rest periods.

Mycosis fungoides

Therapy with Methoblastin appears to produce clinical remissions in one half of the cases treated. Dosage is usually 2.5 to 10 mg daily by mouth for weeks or months. Dose levels of drug and adjustment of dose regimen by reduction or cessation of drug are guided by patient response and haematologic monitoring.

Psoriasis chemotherapy

The patient should be fully informed of the risks involved and should be under constant supervision of the physician.

All schedules should be continually tailored to the individual patient. Dose schedules should be continually tailored to the individual patient. Dose schedules cited below pertain to an average 70 kg adult. An initial test dose one week prior to initiation of therapy is recommended to detect any idiosyncrasy.

Recommended starting dose - schedule

Weekly single oral dose schedule: 10-25 mg per week until adequate response is achieved. With this dosage schedule, 50 mg per week should ordinarily not be exceeded.

Dosage may be gradually adjusted to achieve optimal clinical response, but not to exceed the maximum stated. Once optimal clinical response has been achieved the dose should be reduced to the lowest possible amount of drug and to the longest possible rest period. The use of Methoblastin may permit the return to conventional topical therapy, which should be encouraged.

Special population

Patients with renal impairment

Methotrexate is excreted primarily by the kidneys. In patients with renal impairment the dose may need to be adjusted to prevent accumulation of drug (see section 4.4, Organ System Toxicity, Renal).

4.3 CONTRAINDICATIONS

- Methotrexate is contraindicated in patients with severe renal impairment.
- In the treatment of psoriasis, methotrexate is contraindicated in pregnant women and in patients with poor nutritional status, bone marrow depression, hepatic disorders or in those with pre-existing blood dyscrasias such as bone marrow hypoplasia, leucopenia, thrombocytopenia or anaemia.
- Methotrexate is contraindicated in patients with overt or laboratory evidence of immunodeficiency syndrome(s).
- Breast feeding is contraindicated in women taking methotrexate.
- Methotrexate is contraindicated in psoriasis patients with serious infections, peptic ulcer disease or ulcerative colitis. Methotrexate is contraindicated in psoriatic patients suffering severe renal disorders, alcoholism or hepatic disorders including alcoholic liver disease or other chronic liver disease.
- Methotrexate is contraindicated in patients with a known hypersensitivity to it or to any of the excipients.
- During methotrexate therapy concurrent vaccination with live vaccines must not be carried out.
- An increased risk of hepatitis has been reported to result from combined use of methotrexate and etretinate. Therefore, the combination of methotrexate with retinoids, such as acitretin, is also contraindicated.

4.4 Special warnings and precautions for use

Both the physician and the pharmacist should emphasise to the patient the importance of the weekly dosing regimen in psoriasis treatment, as mistaken daily use may cause serious and sometimes life-threatening or fatal toxicity (see section 4.4, section 4.2 and section 4.9). For the same reason great care should be taken with dispensing to ensure the correct tablet strength of Methoblastin is given to the patient. Methoblastin is available as 2.5 mg and 10 mg tablets.

Methotrexate has the potential for serious toxicity. Toxic effects may be related in frequency and severity to dose or frequency of administration, but have been seen at all doses. Because

the toxic effects can occur at any time during therapy, it is necessary to follow the patients on methotrexate therapy very closely.

When considering the use of methotrexate for chemotherapy, clinicians must evaluate the need and potential value of the drug against the risks, adverse effects or toxic effects. Most adverse effects are reversible if detected early. When such reactions do occur, the drug should be reduced in dosage or discontinued and appropriate corrective measures should be taken. If methotrexate therapy is reinstated, it should be carried out with utmost caution, with adequate consideration of further need for the drug, and with increased alertness as to possible recurrence of toxicity.

Because of the possibility of fatal or severe toxic reactions the patient should be fully informed by the doctor of the risks involved before commencing methotrexate treatment, and should remain under the physician's constant supervision. Close monitoring for toxicity throughout treatment is mandatory, particularly in high dose therapy, or where drug elimination could be impaired (e.g., renal impairment, pleural effusion, ascites).

Use with caution in the following circumstances

Methotrexate must be used only by doctors experienced in antimetabolite chemotherapy or in the case of non-oncological conditions, by a specialist doctor.

Particular attention is recommended for patients with renal impairment, as it may lead to renal failure.

Methotrexate should be used with extreme caution in the presence of debility and in extreme youth or age (see section 4.4).

Methotrexate exits slowly from the third-space compartments (e.g., pleural effusions or ascites) which results in a prolonged terminal phase half-life and unexpected toxicity. In patients with significant third-space accumulation, it is advisable to evacuate the fluid before treatment and to monitor plasma methotrexate levels. Such patients require especially careful monitoring for toxicity, and require dose reduction, or in some cases, discontinuation of methotrexate administration.

Deaths have been reported with use of methotrexate in the treatment of malignancy and psoriasis.

In the treatment of psoriasis, methotrexate should be restricted to severe, recalcitrant, disabling disease, which is not adequately responsive to other forms of therapy, but only when the diagnosis has been established, as by biopsy and / or after appropriate consultation.

Malignant lymphomas may occur in patients receiving low dose methotrexate, in which case therapy must be discontinued. These lymphomas may regress following withdrawal of methotrexate without requiring treatment. Failure of the lymphoma to show signs of spontaneous regression requires initiation of cytotoxic therapy.

Methotrexate, like other cytotoxic drugs, may trigger tumour lysis syndrome in patients with rapidly growing tumours.

Patients receiving immunosuppressive therapy, including methotrexate, are at an increased risk of developing skin cancer (melanoma and non-melanoma). The risk appears to be related to the intensity and duration of immunosuppression rather than to the use of any specific agent.

Periodic skin examination is recommended for all patients who are at increased risk for skin cancer and exposure to sunlight and UV light should be limited by wearing protective clothing and using a sunscreen with a high protection factor.

Folinic acid deficiency

Folinic acid deficiency states may increase methotrexate toxicity.

Adequate folinic acid (calcium folinate) protection is indicated in high-dose methotrexate therapy. The administration of calcium folinate, hydration, and urine alkalinisation should be carried out with constant monitoring of the toxic effects and the elimination of methotrexate. Appropriate calcium folinate administration can be discontinued when the serum methotrexate concentration level is below 10^{-8} M (see also section 4.9).

If acute methotrexate toxicity occurs, patients may require folinic acid. In patients with psoriasis, folic acid or folinic acid may reduce methotrexate toxicities such as gastrointestinal symptoms, stomatitis, alopecia, and elevated liver enzymes.

Before taking a folate supplement, it is advisable to check B12 levels, particularly in adults over the age of 50, since folate administration can mask symptoms of B12 deficiency.

Hepatotoxic or haematotoxic DMARDs (disease-modifying antirheumatic drugs)

Concomitant use of hepatotoxic or haematotoxic DMARDs (disease-modifying antirheumatic drugs, e.g., leflunomide) is not advisable.

Organ system toxicity

Haematologic

Methotrexate may produce marked depression of bone marrow, anaemia, aplastic anaemia, pancytopenia, leucopenia, neutropenia, thrombocytopenia and bleeding. Leukocytes and neutrophils may occasionally show two depressions, the first occurring in 4-7 days and a second nadir after 12-21 days, followed by recovery. Clinical sequelae such as fever, infections and haemorrhage from various sites and septicaemia may be expected.

Methotrexate should not be used in patients with pre-existing haematopoietic impairment (see section 4.3).

Pretreatment and periodic haematologic studies are essential to the use of methotrexate in chemotherapy because of the common effect of haematopoietic suppression. This may occur abruptly and on apparent safe dosage, and any profound drop in blood cell count indicates immediate stoppage of the drug and appropriate therapy.

If profound leucopenia occurs during therapy, bacterial infection may occur or become a threat. Cessation of the drug and appropriate antibiotic therapy is usually indicated. In severe bone marrow depression, blood or platelet transfusions may be necessary.

In the treatment of neoplastic diseases, methotrexate should be continued only if the potential benefit outweighs the risk of severe myelosuppression. In psoriasis, methotrexate should be stopped immediately if there is a significant drop in blood cell counts.

Folate supplementation may permit continuation of methotrexate therapy with resolution of anaemia.

Concomitant administration of folate antagonists such as trimethoprim/sulphamethoxazole has been reported to cause an acute megaloblastic pancytopenia in rare instances (see section 4.5).

Megaloblastic anaemia has also been reported, mainly in elderly patients receiving long-term weekly methotrexate therapy.

Musculoskeletal

Methotrexate given concomitantly with radiotherapy may increase the risk of soft tissue necrosis and osteonecrosis.

Infection or immunologic states

Any infections should be attended to before initiation of methotrexate therapy. Methotrexate should be used with extreme caution in the presence of active infections, and is usually contraindicated in patients with overt or laboratory evidence of immunodeficiency syndromes. Methotrexate therapy has immunosuppressive activity which can potentially lead to serious or even fatal infections. Potentially fatal opportunistic infections, especially *Pneumocystis jirovecii* pneumonia, may occur with methotrexate therapy. This factor must be taken into consideration in evaluating the use of the drug where immune responses in a patient may be important or essential.

Pneumonia (in some cases leading to respiratory failure) may occur. Potentially fatal opportunistic infections, especially *Pneumocystis jirovecii* pneumonia, may occur with methotrexate therapy. When a patient presents with pulmonary symptoms, the possibility of *Pneumocystis jirovecii* pneumonia should be considered.

Signs/symptoms of infection should be carefully observed and aggressive antibiotic therapy may be necessary.

Immunisation

Methotrexate has some immunosuppressive activity and immunisation may be ineffective when given during methotrexate therapy. Immunisation with live virus vaccines is contraindicated during therapy (see section 4.3 and section 4.5).

Gastrointestinal

Methotrexate antineoplastic therapy should be used with extreme caution in the presence of peptic ulcer and ulcerative colitis. Methotrexate is contraindicated in psoriasis patients with peptic ulcer disease or ulcerative colitis (see section 4.3).

Gastrointestinal disorders frequently require dosage adjustment. Vomiting, diarrhoea and ulcerative stomatitis are frequent toxic effects and require interruption of therapy; otherwise haemorrhagic enteritis and death from intestinal perforation may occur. Supportive therapy (including preventing dehydration) should be instituted until recovery occurs.

In rare cases the effect of methotrexate on the intestinal mucosa has led to malabsorption or toxic megacolon.

Hepatic

Methotrexate may cause acute and chronic hepatotoxicity, particularly at high dosage or with prolonged therapy, including liver atrophy, necrosis, hepatic cirrhosis, acute hepatitis, fatty changes and periportal fibrosis. Transient and asymptomatic elevations of liver enzymes are

frequently seen after methotrexate administration and are usually not a reason for modification of methotrexate therapy or predictive of subsequent hepatic disease.

Persistent abnormalities and/or significant decreases in serum albumin may be indicators of serious liver toxicity and require evaluation. Liver biopsy after sustained use often shows histological changes. Chronic (fibrosis and cirrhosis) liver toxicity is potentially fatal and may occur following prolonged (2 years or longer) treatment and high cumulative drug doses of at least 1.5 grams.

Particular attention should be given to the appearance of liver toxicity, since changes may occur without previous signs of gastrointestinal or haematologic toxicity. It is imperative that liver function be determined prior to initiation of treatment and monitored regularly throughout therapy (see section 4.4). Special caution is indicated in the presence of pre-existing liver damage or impaired hepatic function.

Methotrexate has caused reactivation of hepatitis B infection or worsening of hepatitis C infections, in some cases resulting in death. Some cases of hepatitis B reactivation have occurred after discontinuation of methotrexate. Clinical and laboratory evaluation should be performed to evaluate pre-existing liver disease in patients with prior hepatitis B or C infections. Based on these evaluations, treatment with methotrexate may not be appropriate for some patients.

The primary risk factors for severe liver damage, due to methotrexate hepatotoxicity, include: previous liver disease, repeatedly abnormal liver function tests, alcohol consumption/abuse, hepatopathy (including chronic hepatitis B or C), and a family history of hepatopathy. Secondarily risk factors (with possibly lower relevance) for methotrexate hepatotoxicity include diabetes mellitus (in patients treated with insulin), obesity and exposure to hepatotoxic medicines or chemicals. Additional hepatotoxic medicinal products should not be taken during the treatment of methotrexate unless clearly necessary and the consumption of alcohol should be avoided (see section 4.5).

In studies in psoriatic patients, hepatotoxicity appeared to be correlated not only to the cumulative dose of the drug but also to the presence of concurrent conditions such as alcoholism, obesity, diabetes, advanced age and arsenical compounds.

Although liver biopsy is currently believed to be the only reliable measure of methotrexate-induced hepatotoxicity, it is imperative that hepatic function be determined, by liver function tests, prior to initiation of treatment and monitored regularly throughout therapy (see section 4.4).

Pulmonary

Acute or chronic interstitial pneumonitis and pleural effusion, often associated with blood eosinophilia, may occur and deaths have been reported. Patients should be closely monitored for pulmonary signs and symptoms at each follow-up visit.

Rheumatoid arthritis patients are at risk of developing rheumatoid lung disease, which is often associated with interstitial pulmonary disease. Methotrexate may exacerbate this underlying lung disease.

Pulmonary symptoms (especially a dry non-productive cough) or a non-specific pneumonitis occurring during methotrexate therapy may be indicative of a potentially dangerous lesion and require interruption of treatment and careful investigation. Although clinically variable, the

typical patient with methotrexate-induced lung disease presents with fever, cough, thoracic pain, chest pain, dyspnoea, hypoxaemia and an infiltrate on x-ray. Pulmonary lesions can occur at all dosages. Infection (including pneumonia) needs to be excluded in patients presenting with symptoms of pulmonary toxicity.

In addition, pulmonary alveolar haemorrhage has been reported with methotrexate used in rheumatologic and related indications. This event may also be associated with vasculitis and other comorbidities. Prompt investigations should be considered when pulmonary alveolar haemorrhage is suspected to confirm the diagnosis.

Methotrexate should be discontinued from patients with pulmonary symptoms and a thorough investigation undertaken to exclude infection.

If methotrexate induced lung disease is suspected, treatment with corticosteroids should be initiated and treatment with methotrexate should not be restarted. Methotrexate-induced pulmonary toxicity may not be fully reversible.

Neurotoxicity

Systemic high-doses of methotrexate may cause significant CNS toxicity: patients should be closely monitored for neurologic signs/symptoms. If such manifestations occur the treatment should be discontinued and appropriate therapy instituted.

Since cases of encephalopathy/leucoencephalopathy have occurred in cancer patients treated with methotrexate, this cannot be ruled out either for patients with non-cancer indications.

A transient acute neurologic syndrome has been observed in patients treated with high dosing regimens. Manifestations of this neurologic syndrome may include behavioral abnormalities, focal sensorimotor signs, including transient blindness, and abnormal reflexes. The exact cause is unknown.

Skin

Severe, occasionally fatal, dermatological reactions, including toxic epidermal necrolysis (Lyell's syndrome), Stevens-Johnson syndrome, exfoliative dermatitis, skin ulceration/necrosis and erythema multiforme have been reported in children and adults within days of methotrexate administration. Reactions were noted after single or multiple doses of methotrexate in patients with neoplastic and non-neoplastic diseases.

Burning and erythema may appear in psoriatic areas for 1-2 days following each dose, aggravated by concomitant exposure to ultraviolet radiation. Radiation dermatitis and sunburn may be "recalled".

Renal

Methotrexate is contraindicated in patients with severe renal impairment (see section 4.3).

Methotrexate is excreted principally by the kidneys. Risk of renal damage leading to acute renal failure is due primarily to the precipitation in the kidney of the unchanged drug and metabolite (7-hydroxy methotrexate). Renal function should be closely monitored before, during and after treatment. Impaired renal function may result in methotrexate accumulation in toxic amount or even additional renal damage. Methotrexate therapy should be undertaken with caution in patients with renal impairment.

Drug dosage should be reduced or discontinued until renal function is improved or restored. High doses may cause the precipitation of methotrexate or its metabolites in the renal tubules. A high fluid throughput and alkalinisation of the urine to pH 6.5 – 7.0 throughout therapy with methotrexate is recommended as a preventative measure (methotrexate is a weak acid and tends to precipitate at urine pH below 6.0). The urine should be kept alkaline throughout therapy with methotrexate.

Concomitant use of proton pump inhibitors (PPIs) and high dose methotrexate should be avoided, especially in patients with renal impairment (see section 4.5).

Laboratory monitoring

In general, the following laboratory tests are recommended as part of essential clinical evaluation and appropriate monitoring of patients chosen for or receiving methotrexate therapy: a complete blood cell count (with differential and platelet counts), haematocrit, urinalysis, renal function tests, hepatitis B or C infection testing and liver function tests, and a chest x-ray. The tests should be performed prior to therapy, at appropriate periods during therapy, and after termination of therapy. On initiating therapy or changing doses, or during periods of increased risk of elevated methotrexate blood levels (e.g., dehydration), more frequent monitoring may also be indicated.

During therapy for psoriasis, monitoring of haematological parameters (at least one monthly) and liver and renal function (every one to two months) is recommended. In oncological patients more frequent monitoring is usually indicated.

Pulmonary function tests

Pulmonary function tests may be useful if lung disease (e.g., interstitial pneumonitis) is suspected, especially if baseline measurements are available.

Methotrexate level

Serum methotrexate level monitoring can significantly reduce toxicity and mortality by allowing the adjustment of methotrexate dosing and the implementation of appropriate rescue measures.

Patients subject to the following conditions are predisposed to developing elevated or prolonged methotrexate levels and benefit from routine monitoring of levels: e.g., pleural effusion, ascites, gastrointestinal tract obstruction, previous cisplatin therapy, dehydration, aciduria, impaired renal function.

Some patients may have delayed methotrexate clearance in the absence of these features. It is important that patients be identified within 48 hours since methotrexate toxicity may not be reversible if adequate folinic acid rescue is delayed for more than 42 to 48 hours.

Monitoring of methotrexate concentrations should include determination of a methotrexate level at 24, 48, or 72 hours, and assessment of the rate of decline in methotrexate concentrations (to determine how long to continue folinic acid rescue).

Liver function tests

Treatment should not be instituted or should be discontinued if any abnormalities of liver function tests, or liver biopsy, are present or develop during therapy. Such abnormalities should return to normal within two weeks after which treatment may be recommenced at the discretion of the physician.

Temporary increases in transaminases to 2 – 3 x ULN have been reported by patients. In the case of a constant increase in liver-related enzyme, a reduction of the dose or discontinuation of therapy should be considered. Closer monitoring of liver enzymes is necessary especially in patients taking other hepatotoxic or haematotoxic medicinal products (e.g., leflunomide).

More frequent check-ups of liver function may become necessary during the initial phase of treatment, when the dose is increased and during episodes of a higher risk of elevated methotrexate blood levels (e.g., dehydration, impaired renal function, additional or elevated dose of medicines administered concomitantly, such as NSAIDs).

The need for liver biopsy should be evaluated on an individual basis and national recommendations should be followed. Periodic liver biopsies are usually recommended for psoriatic patients who are under long-term treatment.

Psoriasis

Liver damage and function tests, including serum albumin and prothrombin time, should be performed several times prior to dosing. Liver function tests are often normal in developing fibrosis or cirrhosis and may not be preceded by symptoms. These lesions may be detectable only by biopsy. It is recommended to obtain a liver biopsy at 1) before start of therapy or shortly after initiation of therapy (2-4 months); 2) after a total cumulative dose of 1.5 grams; and 3) after each additional 1.0 to 1.5 grams.

In case of moderate fibrosis or any cirrhosis, discontinue the drug; mild fibrosis normally suggests a repeat biopsy in 6 months.

Milder histologic findings such as fatty change and low grade portal inflammation are relatively common before the start of therapy. Although these mild changes are normally not a reason to avoid or discontinue methotrexate therapy, the drug should be used with caution.

Information for patients

Patients should be informed of the potential benefit and risk in the use of methotrexate. The risk of effects on reproduction should be discussed with both male and female patients taking methotrexate.

Patients should be informed of the risks in the use of methotrexate (including the early signs and symptoms of toxicity), of the need to see their physician promptly if they occur, and of the need for close follow-up, including regular laboratory tests to monitor toxicity.

Patients should be informed that the dose of methotrexate is once weekly in the treatment of psoriasis (see Section 4.2). The prescriber should specify the day of intake on the prescription. Pharmacists should clearly indicate the day of the week the weekly dose is to be taken on the dispensing label. Patients should be aware of importance of adhering to the once weekly intake and that daily administration can lead to serious toxic effects.

Patients should be advised to report all symptoms or signs suggestive of infection.

Patients should be informed of the risk of pneumonitis and advised to contact their doctor immediately should they develop persistent cough or dyspnoea. Patients should be advised to contact their doctor immediately if they experience symptoms of spitting or coughing up blood.

Patients receiving methotrexate should avoid excessive unprotected exposure to sun or sunlamps because of possible photosensitivity reactions and increased risk of skin cancer (non-melanoma and melanoma).

Patients should be advised that adverse reactions to methotrexate, such as dizziness and fatigue, may affect their ability to drive or operate machinery.

Methoblastin tablets contain lactose. Patients with rare hereditary problems of galactose intolerance, the Lapp lactase deficiency or glucose-galactose malabsorption should not take this medicine.

Paediatric use

Cases of overdose by miscalculation of dosage (particularly in juveniles) have occurred. Special attention must be given to dose calculation (see section 4.2).

Use in elderly

Fatal toxicities related to inadvertent daily rather than weekly dosing have been reported, particularly in elderly patients. It should be emphasised to the patient that the recommended dose is taken weekly for psoriasis (see section 4.2).

Due to diminished hepatic and renal functions as well as decreased folate states in elderly patients, relatively low doses should be considered and these patients should be closely monitored.

4.5 Interactions with other medicines and other forms of interactions

Chemotherapeutic agents

Enhancement of nephrotoxicity may be seen if high-dose methotrexate is administered in combination with a potentially nephrotoxic chemotherapeutic agent (e.g., cisplatin).

L-asparaginase

The administration of L-asparaginase has been reported to antagonise the effect of methotrexate.

Mercaptopurine

Methotrexate increases the plasma levels of mercaptopurine. Combination of methotrexate and mercaptopurine may therefore require a dose adjustment.

Drug highly bound to plasma proteins

Methotrexate is bound in part to serum albumin after absorption, and toxicity may be increased because of displacement by other highly bound drugs such as salicylates, sulfonamides, sulfonyleureas, phenytoin, phenylbutazone, aminobenzoic acid and some antibiotics such as penicillins, tetracycline, pristinamycin, probenecid and chloramphenicol. When methotrexate is used concurrently with these drugs, its toxicity may be increased.

Hypolipidaemic compounds

Hypolipidaemic compounds such as cholestyramine proved preferential binding substrates compared to serum proteins when given in combination to methotrexate. These drugs, especially salicylates and sulphonamides, whether antibacterial, hypoglycaemic or diuretic, should not be given concurrently until the significance of these findings is established.

Probenecid and drugs reducing tubular secretion

Since probenecid and weak organic acids, such as “loop-diuretics”, as well as pyrazoles reduce tubular secretion, great caution should be exercised when these medicinal products are coadministered with methotrexate.

Nonsteroidal Anti-inflammatory Drugs (NSAIDs)

NSAIDs should not be administered before or concomitantly with high-dose methotrexate such as used in the treatment of osteosarcoma. Concomitant administration of some NSAIDs with high-dose methotrexate has been reported to elevate and prolong serum methotrexate levels, resulting in deaths from severe haematological (including bone marrow suppression and aplastic anaemia) and gastrointestinal toxicity.

Caution should be used when NSAIDs and salicylates are administered concomitantly with lower doses of methotrexate. These drugs have been reported to reduce tubular secretion of methotrexate in an animal model and may enhance its toxicity by increasing methotrexate levels.

Unexpectedly severe (sometimes fatal) marrow suppression, aplastic anaemia and gastrointestinal toxicity have been reported with concomitant administration of methotrexate (usually in high doses) with NSAIDs, including aspirin and other salicylates, azapropazone, diclofenac, indomethacin and ketoprofen. The mechanism is uncertain but may include both displacement of methotrexate from protein-binding sites or an inhibiting effect of NSAIDs on prostaglandin E2 synthesis yielding to a significant decrease of blood renal flow, resulting in reduced methotrexate excretion. Naproxen has been reported not to affect the pharmacokinetics of methotrexate, but a fatal interaction has been reported.

Antibiotics

Ciprofloxacin

Renal tubular transport is diminished by ciprofloxacin; use of methotrexate with this drug should be carefully monitored.

Penicillins and sulphonamides

Penicillins and sulfonamides may reduce the renal clearance of methotrexate, thereby increasing serum concentrations of methotrexate. Haematologic and gastrointestinal toxicity have been observed in combination with high- and low- dose methotrexate. Use of methotrexate with penicillins and sulfonamides should be carefully monitored.

Oral antibiotics

Reduced oral methotrexate absorption from the gastrointestinal tract has been seen in the presence of oral antibiotics. Oral antibiotics such as tetracycline, chloramphenicol and non-absorbable broad-spectrum antibiotics, may decrease intestinal absorption of methotrexate or interfere with the enterohepatic circulation by inhibiting bowel flora and suppressing metabolism of the drug by bacteria. Trimethoprim/sulfamethoxazole has been reported rarely to increase bone marrow suppression in patients receiving methotrexate probably by decreased tubular secretion and/or an additive antifolate effect.

Concurrent use of the anti-protozoal *pyrimethamine* may increase the toxic effects of methotrexate because of an additive antifolate effect.

Vitamins

Vitamin preparations containing folic acid or its derivatives may decrease response to methotrexate and should not be given concomitantly. Folate deficiency states may increase methotrexate toxicity.

Assay for folate: Methotrexate may inhibit the organism used in the assay and interfere with detection of folic acid deficiency.

Other cytotoxic drugs

Methotrexate is often used in combination with other cytotoxic drugs. Additive toxicity may be expected in chemotherapy regimens which combine drugs with similar pharmacologic effects and special monitoring should be made with regard to bone marrow depression, renal, gastrointestinal and pulmonary toxicity. The dosage of methotrexate should be adjusted if it is used in combination with other chemotherapeutic agents with overlapping toxicities.

Hepatotoxic agents

Concurrent use of other potentially hepatotoxic agents (e.g., leflunomide, sulfasalazine and alcohol) should be avoided due to an increased risk of hepatotoxicity. Special caution should be exercised when observing patients receiving methotrexate therapy in combination with azathioprine. The combination of methotrexate with retinoids, such as acitretin, is contraindicated (see section 4.3).

Allopurinol

Concomitant use of allopurinol with methotrexate may result in an increased incidence of cytotoxic-induced bone marrow depression.

Leflunomide

Methotrexate in combination with leflunomide may also increase the risk of pancytopenia and interstitial pneumonitis.

Nitrous oxide anaesthesia

The use of nitrous oxide anaesthesia potentiates the effect of methotrexate on folate metabolism, yielding increased toxicity such as severe, unpredictable myelosuppression, stomatitis and neurotoxicity with intrathecal administration. Whilst this effect can be reduced by the use of folinic acid rescue (see section 4.9), avoid concomitant use of nitrous oxide in patients receiving methotrexate. Use caution when administering methotrexate after a recent history of nitrous oxide administration.

Amiodarone

Amiodarone administration to patients receiving methotrexate treatment for psoriasis has induced ulcerative skin lesions.

Psoralen plus ultraviolet light (PUVA) therapy

Skin cancer has been reported in a few patients with psoriasis or mycosis fungoides (a cutaneous T-cell lymphoma) receiving concomitant treatment with methotrexate plus PUVA therapy (methoxalen and ultraviolet light).

Packed red blood cells

Care should be exercised whenever packed red blood cells and methotrexate are given concurrently. Patients receiving 24 hour methotrexate infusion and subsequent transfusions have showed enhanced toxicity probably resulting from prolonged serum-methotrexate concentrations.

Vaccines

Methotrexate is an immunosuppressant and may reduce immunological response to concurrent vaccination. Severe antigenic reactions may occur if a live vaccine is given concurrently.

Vaccination with a live vaccine in patients receiving chemotherapeutic agents may result in severe and fatal infections and are therefore contraindicated (see section 4.3).

Theophylline

Methotrexate may decrease the clearance of theophylline; theophylline levels should be monitored when used concurrently with methotrexate.

Diuretics

Bone marrow suppression and decreased folate levels have been described in the concomitant administration of triamterene and methotrexate.

Proton pump inhibitors

Coadministration of proton pump inhibitors (PPIs) (e.g., omeprazole, pantoprazole) with methotrexate may decrease the clearance of methotrexate causing elevated methotrexate plasma levels with clinical signs and symptoms of methotrexate toxicity. Concomitant use of proton pump inhibitors and high dose methotrexate should therefore be avoided, especially in patients with renal impairment (see section 4.4).

Phenytoin

Cytotoxic agents may impair absorption of phenytoin, which may decrease efficacy of phenytoin and increase the risk for exacerbation of convulsions. Risk of toxicity enhancement or loss of efficacy of the cytotoxic drug due to increased hepatic metabolism by phenytoin is possible.

Ciclosporin

Ciclosporin may potentiate methotrexate efficacy and toxicity. There is a risk of excessive immunosuppression with risk of lymphoproliferation when the combination is used.

4.6 Fertility, pregnancy and lactation

Fertility

Methotrexate has been reported to cause impairment of fertility, defective oogenesis or spermatogenesis, oligospermia, menstrual dysfunction and amenorrhoea in humans, during and for a short period after cessation of therapy.

Men undergoing methotrexate therapy should use contraception, and not father a child, during and for three months after treatment because methotrexate may be genotoxic and has caused increased number of abnormal and immobile spermatozoa in clinical studies.

Since treatment with methotrexate can lead to severe and possibly irreversible disorders in spermatogenesis, men should seek advice about the possibility of sperm preservation before starting the therapy. Men should not donate semen during therapy or for 3 months following discontinuation of methotrexate.

The possible risks of effects on reproduction should be discussed with patients of childbearing potential (see section 4.6).

Use in pregnancy

Category D

Use of methotrexate is contraindicated throughout pregnancy (see section 4.3).

Methotrexate has been shown to be teratogenic. Methotrexate has caused embryotoxicity, abortion, fetal death and/or congenital abnormalities when administered to pregnant women.

Methotrexate is not recommended in women of childbearing potential unless there is appropriate medical evidence that the benefits are expected to outweigh the considered risks.

Women of childbearing potential should not be started on methotrexate until any existing pregnancy is excluded with certainty by taking appropriate measures, e.g., pregnancy test prior to initiating therapy.

Both male and female patients should be fully counselled on the serious risk to the fetus should they become pregnant while undergoing treatment.

Pregnancy should be avoided and reliable effective contraception used if either partner is receiving methotrexate, during and for a minimum of six months after therapy has ceased, for women and three months after therapy has ceased for men. The optimal time interval between the cessation of methotrexate treatment of either partner, and pregnancy, has not been clearly established.

Teratogenicity

There is evidence of a teratogenic risk in humans (craniofacial, cardiovascular and extremity malformations) and in several animal species.

Use in lactation

Methotrexate passes into breast milk and is contraindicated during breastfeeding (see section 4.3). Because of the potential for serious adverse reactions from methotrexate in breast fed infants, it is contraindicated in nursing mothers.

4.7 Effects on ability to drive and use machinery

Central nervous system symptoms, such as fatigue and dizziness, can occur during treatment with methotrexate which may have minor or moderate influence on the ability to drive and use machines.

4.8 Undesirable effects

Many side effects of methotrexate therapy are unavoidable being due to the pharmacological actions of the drug. However, the adverse effects are generally reversible if detected early.

The major toxic effects of methotrexate occur on normal, rapidly proliferating tissues, particularly the bone marrow and the gastrointestinal tract. See section 4.4 for specific reference to medically important and long term events including those following long term treatment or high cumulative doses (e.g., hepatic toxicity). Ulcerations of the oral mucosa are usually the earliest signs of toxicity.

When adverse reactions do occur, the drug should be reduced in dosage or discontinued and appropriate corrective measures should be taken. This includes the use of folinic acid (calcium folinate)(see section 4.4 and section 4.9).

The most common adverse reactions of methotrexate are bone marrow suppression and mucosal damage which manifest as ulcerative stomatitis, leucopenia, thrombocytopenia, nausea and other gastrointestinal disorders. Other reported adverse reactions include malaise, undue fatigue, chills and fever, headaches, dizziness, drowsiness, tinnitus, blurred vision, eye discomfort and decreased resistance to infections.

In general, the incidence and severity of side effects are related to the dose, the dosing frequency, the method of administration and the duration of exposure. Adverse reactions are most common when using high and repeated doses of methotrexate in the treatment of malignant neoplasms.

Adverse reactions as reported for the various organ systems are as follows:

Infections and infestations: Infections (including fatal sepsis), decreased resistance to infection, opportunistic infections (sometimes fatal in patients receiving methotrexate therapy for neoplastic and non-neoplastic diseases), pneumonia, *pneumocystis jirovecii* pneumonia (most common infection), respiratory tract infection, cutaneous bacterial infections, sepsis, nocardiosis, histoplasmosis, cryptococcosis, herpes zoster, herpes simplex hepatitis, disseminated herpes simplex, cytomegalovirus infection (including cytomegaloviral pneumonia), reactivation of hepatitis B infection, worsening of hepatitis C infection.

Neoplasms benign, malignant, and unspecified (including cysts and polyps): Lymphoma (including reversible lymphoma), tumour lysis syndrome, melanoma and non-melanoma skin cancer.

Blood and lymphatic system disorders: Bone marrow failure, bone marrow depression, leucopenia, neutropenia, thrombocytopenia, anaemia (including aplastic anaemia), megaloblastic anaemia, eosinophilia, pancytopenia, agranulocytosis, lymphadenopathy, lymphoproliferative disorders (including reversible), haemorrhage (from various sites) is expected following methotrexate therapy, septicæmia.

Immune system disorders: Anaphylactoid reaction, anaphylactic reaction, hypogammaglobulinaemia.

Metabolism and nutrition disorders: Diabetes mellitus, metabolic disorder.

Psychiatric disorders: Depression, confusional state, irritability, transient cognitive dysfunction, mood altered.

Nervous system disorders: Paraesthesia, headaches, dizziness, drowsiness, convulsions, speech impairment, paresis, dysarthria, lethargy, motor dysfunction, cranial nerve disorder, cranial nerve palsies, brain oedema, aphasia, hemiparesis, leucoencephalopathy,

encephalopathy, CSF pressure increased, neurotoxicity, arachnoiditis, coma, paraplegia, stupor, ataxia, dementia, unusual cranial sensations, Guillain Barre Syndrome.

Eye disorders: Conjunctivitis, blurred vision, eye discomfort, serious visual changes (of unknown aetiology), transient blindness/vision loss.

Ear and labyrinth disorders: Tinnitus.

Cardiac disorders: Pericarditis, pericardial effusion, pericardial tamponade, pulmonary oedema.

Vascular disorders: Vasculitis, hypotension, thromboembolic events (including arterial thrombosis, cerebral thrombosis, deep vein thrombosis, retinal vein thrombosis thrombophlebitis and pulmonary embolism).

Respiratory, thoracic and mediastinal disorders: Pneumonitis, interstitial pneumonitis (including fatalities), respiratory fibrosis, interstitial/pulmonary fibrosis, reversible eosinophilic pulmonary infiltrates, chronic interstitial obstructive pulmonary disease, pulmonary alveolar haemorrhage (has been reported for methotrexate used in rheumatologic and related indications), pharyngitis, alveolitis, pleural effusion, pleurisy, dyspnoea, chest pain, hypoxia, cough (especially dry and non-productive), respiratory failure.

Gastrointestinal disorders: Mucositis, stomatitis, gingivitis, glossitis, as well as decreased appetite (anorexia), nausea, vomiting, diarrhoea, gastrointestinal ulceration (including oral ulcers) and bleeding, pancreatitis, intestinal perforation, haematemesis, melaena, non-infectious peritonitis, malabsorption, enteritis, toxic megacolon and abdominal distress.

Hepatobiliary disorders: Hepatic failure, acute and chronic hepatotoxicity, acute liver atrophy, necrosis, fatty metamorphosis, acute hepatitis, periportal fibrosis, chronic fibrosis, hepatic cirrhosis, elevated liver enzymes, increase of transaminases, decrease in serum albumin. Alteration of liver function tests (increases in transaminases and LDH levels) is commonly reported but usually resolves within one month after cessation of therapy.

Skin and subcutaneous tissue disorders: Toxic epidermal necrolysis (Lyell's syndrome), Stevens-Johnson's syndrome, exfoliative dermatitis, painful erosion of psoriatic plaques, skin ulceration, skin necrosis, erythema multiforme, drug reaction with eosinophilia and systemic symptoms, erythematous rashes, urticaria, pruritus, dermatitis, acne, furunculosis, folliculitis, nail disorder, nail hyperpigmentation, acute paronychia, vasculitis, petechiae, ecchymosis, telangiectasia, photosensitivity, pigmentation disorder (depigmentation/hyperpigmentation), and alopecia.

Musculoskeletal, connective tissue and bone disorders: Osteoporosis, osteonecrosis (aseptic necrosis of the femoral head), soft tissue necrosis, abnormal tissue cell changes, arthralgia/myalgia, stress fracture, back pain, nuchal rigidity.

Renal and urinary disorders: Severe nephropathy, renal failure, azotaemia, cystitis, dysuria, haematuria, proteinuria, urogenital dysfunction.

Pregnancy, puerperium and perinatal conditions: Abortion, fetal defects and fetal death

Reproductive system disorders: Defective oogenesis or spermatogenesis, transient oligospermia, menstrual dysfunction, vaginal bleeding, vaginal ulceration, vaginitis, vaginal discharge, gynaecomastia, loss of libido, impotence, infertility.

General disorders and administration site conditions: Sudden death, nodules, pyrexia, chills, malaise, fatigue, oedema, peripheral oedema.

Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medicine is important. It allows continued monitoring of the benefit/risk balance of the medicine. Healthcare professionals are asked to report any suspected adverse reactions <https://nzphvc.otago.ac.nz/reporting/>.

4.9 Overdosage

Cases of overdose (sometimes fatal) due to erroneous daily intake instead of weekly intake of oral methotrexate have been reported (see section 4.4).

Signs and symptoms

Symptoms commonly reported following oral overdose include those symptoms and signs reported at pharmacological doses, particularly haematological and gastrointestinal reactions. These signs and symptoms include leucopenia, thrombocytopenia, anaemia, pancytopenia, bone marrow suppression, mucositis, stomatitis, oral ulceration, nausea, vomiting, gastrointestinal ulceration, gastrointestinal bleeding, anorexia, progressive weight loss and bloody diarrhoea. In some cases of overdose, no symptoms were reported. There have been reports of death following overdose in the self-administered dosage for psoriasis. In these cases, events such as sepsis or septic shock, renal failure and aplastic anaemia were also reported.

Treatment of overdosage

Consider administration of activated charcoal in the event of a potentially toxic ingestion. Activated charcoal is most effective when administered within 1 hour of ingestion. In patients who are not fully conscious or have impaired gag reflex, consideration should be given to administering activated charcoal via nasogastric tube once the airway is protected.

Folinic acid (calcium folinate) neutralises effectively the immediate toxic effects of methotrexate. After an inadvertent overdosage of methotrexate, calcium folinate should be given as soon as possible and preferably started within 1 hour after the administration of methotrexate. As the time interval between methotrexate administration and folinic acid initiation increases, the effectiveness of folinic acid in counteracting toxicity decreases. Monitoring of the serum methotrexate concentration is essential in determining the optimal dose and duration of treatment with folinic acid.

Calcium folinate should be given at 10 mg/m² IV or IM q 6 hours until the serum methotrexate levels are below 10⁻⁸M. In the presence of gastric stasis or obstruction calcium folinate should be administered parenterally. Concomitant hydration (3 L/d) and urinary alkalinisation with sodium bicarbonate should be employed. The bicarbonate dose should be adjusted to maintain a urinary pH at 7 or greater. Serum samples should be assayed for creatinine levels and methotrexate levels at 24 hour intervals. If the 24 hour serum creatinine level has increased 50% over baseline or if the 24 hour methotrexate level is >5 X 10⁻⁶M or the 48 hour methotrexate level is 9 X 10⁻⁷M or higher, the doses of calcium folinate should be increased to 100 mg/m² IV q 3 hours until the methotrexate level is <10⁻⁸M. The infusion rate of calcium folinate should not exceed 16.0 mL (160 mg calcium folinate) per minute. Patients with significant third space accumulations should be considered high-risk and closely monitored until serum methotrexate levels are <10⁻⁸M regardless of their 24 hour serum concentration.

The above mentioned statements on calcium folinate dosage do not apply with high-dosage methotrexate therapy. The dosages of calcium folinate have varied in different studies and the published literature on high-dosage methotrexate should be consulted.

In cases of massive overdose, hydration and urinary alkalisation may be necessary to prevent the precipitation of the drug and/or its metabolites in the renal tubules. Neither standard haemodialysis nor peritoneal dialysis have been shown to significantly improve methotrexate elimination. Some clearance of methotrexate may be obtained by haemodialysis if the patient is totally anuric and no other therapeutic options are available. However, effective clearance of methotrexate has been reported with acute, intermittent haemodialysis using a high-flux dialysator.

For advice on the management of overdose please contact the National Poisons Centre on 0800 POISON (0800 764766).

5. PHARMACOLOGICAL PROPERTIES

Pharmacotherapeutic group: Antineoplastic and immunomodulating agents, antimetabolites, folic acid analogues

ATC code: L01BA01

5.1 Pharmacodynamic properties

Methotrexate (4-amino-10 methyl folic acid) is an antimetabolite and an analogue of folic acid. The drug enters the cells *via* an active transport system for reduced folates and, due to a relatively irreversible binding, the drug inhibits the enzyme dihydrofolate reductase which catalyses the reductive process of folic acid into tetrahydrofolic acid. The inhibited formation of tetrahydrofolates results in an interference with DNA synthesis, repair and cell replication. The affinity of dihydrofolate reductase for methotrexate is far greater than its affinity for folic or dihydrofolic acid and, therefore, even very large amounts of folic acid given simultaneously will not reverse the effects of methotrexate. The drug seems also to cause an increase in intracellular deoxyadenosine triphosphate, which is thought to inhibit ribonucleotide reduction and polynucleotide ligase, an enzyme concerned in DNA synthesis and repair.

Actively proliferating tissues such as malignant cells, bone marrow, fetal cells, buccal and intestinal mucosa, spermatogonia and cells of the urinary bladder are in general more sensitive to the pharmacological actions of methotrexate.

5.2 Pharmacokinetic properties

Absorption

Low oral doses (up to 25 – 30 mg/m²) are rapidly absorbed from the gastrointestinal tract but absorption at higher doses is erratic, possibly because of a saturation effect. Variability in methotrexate absorption has been however detected in subjects receiving oral treatment due to drug-induced epithelial denudation, motility changes and alterations in intestinal flora. In addition, food has been shown to delay absorption and reduce peak concentration. Peak serum levels are reached within 1-5 hrs following oral administration.

Distribution

Approximately 50% of absorbed methotrexate is reversibly bound to serum protein but is easily diffused into body tissue cells, where the drug is actively transported across the cell membranes.

Methotrexate is widely distributed into body tissues with highest concentrations in the kidneys, gallbladder, spleen, liver and skin. Small or insignificant amounts cross the blood-brain barrier and enter CSF following oral or parenteral administration; this may be increased when giving higher doses. Small amounts have been detected in saliva and breast milk. The drug crosses the placental barrier.

Methotrexate is retained for several weeks in the kidneys and for months in the liver, even after a single therapeutic dose. Sustained serum concentrations and tissue accumulation of methotrexate may result from repeated daily doses.

The drug enters slowly into third-space collections of fluid, such as pleural effusions, ascites and marked tissue oedemas.

Biotransformation

At low doses the drug does not appear to undergo significant metabolism; following high-dose therapy methotrexate undergoes hepatic and intracellular metabolism to polyglutamated forms which can be converted back to methotrexate by hydrolase enzymes. A small amount of metabolism to the 7-hydroxy derivative may occur at doses commonly prescribed.

Before absorption, methotrexate may be partly metabolised by the intestinal flora to 2,4-diamino-N10-methylpteroic acid, a pharmacologically inactive metabolite.

Elimination

Clearance from plasma is reported to be triphasic: the first phase probably involves distribution into organs, the second renal excretion and the third the methotrexate passage into the enterohepatic circulation.

The terminal half-life after low oral doses is in the range 3 to 10 hrs. Total clearance averages 12 L/h, but there is wide interindividual variation, delayed drug clearance having been identified as one of the major factors responsible for drug toxicity.

Excretion is mainly through the kidneys via glomerular filtration and active transport. The pattern of elimination, however, varies considerably according to the dosage. Methotrexate excretion is impaired and accumulation occurs more rapidly in patients with impaired renal function. In addition, simultaneous administration of weak organic acids such as salicylates may suppress methotrexate clearance. The drug is slowly released from third-space compartments, giving prolongation of plasma disappearance and increased risk of toxicity.

5.3 Preclinical safety data

The intraperitoneal LD50 of methotrexate was 94 and 6-25 mg/kg for mice and rats, respectively. The oral LD50 of the compound in rats was 180 mg/kg. The tolerance to methotrexate in mice increased with age. In dogs, the intravenous dose of 50 mg/kg was lethal. The main targets after a single dose were the hemolymphopoietic system and G.I. tract.

The toxic effects after repeated administration of methotrexate were investigated in mice and rats. The main targets of methotrexate in the above animal species were the

haemolymphopoietic system, G.I. tract, lung, liver, kidney, testes, and skin. The tolerance of mice to chronic methotrexate doses increased with age.

Carcinogenicity

No controlled human data exist regarding the risk of neoplasia with methotrexate.

Methotrexate has been evaluated in a number of animal studies for carcinogenic potential with inconclusive results.

Cytotoxic drugs have been reported to be associated with an increased risk of development of secondary tumours in humans. Reports of lymphoma, including reversible lymphomas and tumour lysis syndrome have been documented in patients treated with methotrexate.

Malignant lymphomas may occur in patients receiving low dose methotrexate, in which case therapy must be discontinued. Failure of the lymphoma to show signs of spontaneous regression requires initiation of cytotoxic therapy.

Benefit should be weighed against this potential risk before using methotrexate alone or in combination with other drugs, especially in children or young adults.

Genotoxicity

Methotrexate is mutagenic *in vivo* and *in vitro*. There is evidence that methotrexate causes chromosomal damage to animal somatic cells and human bone marrow cells has been reported with methotrexate. The clinical significance of these findings is uncertain.

6. PHARMACEUTICAL PARTICULARS

6.1 List of excipients

Each 2.5 mg and 10 mg tablet contain lactose monohydrate, maize starch, pregelatinised maize starch, polysorbate 80, microcrystalline cellulose, magnesium stearate.

6.2 Incompatibilities

Methotrexate has been reported to be incompatible with cytarabine, fluorouracil and prednisolone.

6.3 Shelf life

60 months.

6.4 Special precautions for storage

Methotrexate tablets should be protected from light and stored at or below 25°C.

6.5 Nature and contents of container

2.5 mg tablets: High density polyethylene (HDPE) plastic bottle containing 30 tablets.

10 mg tablets: High density polyethylene (HDPE) plastic bottle containing 50 tablets.

6.6 Special precautions for disposal and other handling

Individuals who have contact with anti-cancer drugs or work in areas where these drugs are used may be exposed to these agents in air or through direct contact with contaminated objects.

Guidelines and procedures for appropriate handling and disposal of hazardous chemicals should be observed in the handling of cytostatics.

Pregnant staff should be excluded from working with this drug.

7. MEDICINE SCHEDULE

Prescription Medicine

8. SPONSOR

Pfizer New Zealand Limited
P O Box 3998
Auckland, New Zealand, 1140.
Toll Free Number: 0800 736 363.
www.pfizermedicalinformation.co.nz

9. DATE OF FIRST APPROVAL

19 June 1986.

10. DATE OF REVISION OF TEXT

29 August 2023

Summary table of changes

Section changed	Summary of new information
Warnings box	Information on contraception for men and women added.
4.6	Updated contraceptive duration following cessation of treatment to 3 months for males.
4.8	Adverse effects relating to oedema added.
8	Updated sponsor website