

**Corticosteroids and Noncorticosteroid Immunosuppressive Agents:  
Route of Administration, Side Effects and Required Monitoring**

DRUG	PRIMARY ROUTE OF ADMINISTRATION	SIDE EFFECTS	MONITORING REQUIRED
<b>Transcription Factor Inhibitors</b>			
Corticosteroids (Prednisolone, dexamethasone, triamcinolone, prednisone, methylprednisolone)	Topical, periocular, intraocular, oral, intravenous	Cataract, ocular hypertension, systemic hypertension, hyperglycemia, myopathy, adrenal insufficiency, mood changes, cognitive impairment, leukocytosis. Local agents may cause ptosis.	Systemic blood pressure, fasting blood glucose, serum electrolytes, and weight weekly for two weeks, then every four to six weeks thereafter. Bone density at initiation of chronic therapy and periodically thereafter.
Cyclosporine (Sandimmune)	Oral	Nephrotoxicity, hypertension, hepatotoxicity, gastrointestinal upset, gingival hyperplasia, anorexia, hypertrichosis.	Serum creatine, AST, ALT, and blood pressure checks every two weeks for the first month, then every four to six weeks.
Tacrolimus (Prograf)	Oral	Nephrotoxicity, hypertension, hepatotoxicity, neurotoxicity, myocardial hypertrophy, gastrointestinal upset, anorexia.	Serum creatine, AST, ALT, and blood pressure checks every two weeks for the first month, then every four to six weeks.
Sirolimus Rapamycin (Rapamune)	Oral	Increased susceptibility to infection, and possibly lymphoma, hyperlipidosis.	CBC with differential, AST, ALT, and serum lipid levels every two weeks for the first month then every four to six weeks.
<b>Antimetabolites</b>			
Methotrexate (Rheumatrex)	Oral, subcutaneous	Hepatotoxicity, cytopenia, interstitial pneumonia,	CBC with differential, AST, ALT every two weeks for the first month then every four to six weeks.

		gastrointestinal upset, rash, alopecia, anorexia.	
Azothioprine (Imuran)	Oral	Bone marrow suppression (reversible) increased risk of malignancies (non-Hodgkin's lymphoma), gastrointestinal upset, rash, alopecia, anorexia.	CBC with differential, AST, ALT every two weeks for first month then every four to six weeks.
Leflunomide (Arava)	Oral	Hepatotoxicity, leukopenia, gastrointestinal upset, anorexia, rash, alopecia.	CBC with differential, AST, ALT every two weeks for the first month then every six weeks.
Mycophenolate mofetil (Cellcept)	Oral	Secondary malignancy, bone marrow suppression, gastrointestinal upset (very common), opportunistic infections (CMV, HSV).	CBC with differential, AST, ALT every two weeks for the first month then every four to six weeks.
<b>Cytotoxics</b>			
Cyclophosphamide (Cytoxan)	Oral	Bone marrow suppression, hemorrhagic cystitis, malignancy (bladder), gastrointestinal upset, infection, infertility.	CBC with differential, AST, ALT weekly for first month (or until appropriate WBC achieved) then every two to four weeks.
Chlorambucil (Leukeran)	Oral	Bone marrow suppression, teratogenesis, gastrointestinal upset, infection, infertility.	CBC with differential, AST, ALT weekly for the first month (or until appropriate WBC achieved) then every two to four weeks.
<b>Miscellaneous Mechanisms of Action</b>			

Colchicine	Oral	Thrombocytopenia, anemia, hypokalemia, gastrointestinal upset, anorexia rash, hypercholesterolemia	CBC with differential, AST, ALT and serum electrolytes every two weeks for the first month then every four to six weeks.
Dapsone	Oral	Dose-dependent hemolytic anemia with or without G6-PD deficiency, methemoglobinemia, gastrointestinal upset.	CBC with differential, AST, ALT and serum electrolytes every two weeks for the first month then every four to six weeks, LFTs every one to two months.
<b>Biologicals</b>			
Interferon-alpha 2a (Roferon-A)	Subcutaneous	Increased risk of tuberculosis reactivation, leukopenia, thrombocytopenia, severe depression, flu-like symptoms, erythema at injection site, alopecia, gastrointestinal upset.	CBC with differential, AST, ALT, and serum electrolytes every two weeks for first month then every two to four weeks. Periodic ophthalmic examination (to rule out interferon retinopathy) and psychiatric evaluation.
Daclizumab (Zanapax)	Subcutaneous	Increased risk of cellulitis and wound infections. Hives, lower extremity edema, dermatitis.	CBC with differential, AST, ALT and serum electrolytes every two weeks for the first month then every four to six weeks.
Infliximab (Remicade)	Intravenous	TB reactivation, increased risk of serious infections and sepsis, injection site reactions including erythema, itching, swelling, demyelinating disease, possible lymphoma.	Rule out prior tuberculosis infection with PPD and chest radiograph. CBC with differential, AST, ALT, and serum electrolytes every two weeks for the first month then every four to six weeks. <b>Must be given with methotrexate to limit the formation of neutralizing antibodies.</b>
Etanercept (Enbrel)	Subcutaneous	TB reactivation, increased risk of	Rule out prior tuberculosis infection with PPD and chest

		serious infections and sepsis, injection site reactions including erythema, itching, swelling, demyelinating disease, lymphoma.	radiograph. CBC with differential, AST, ALT, every two weeks for the first month then every four to six weeks.
Adalimumab (Humira)	Subcutaneous	TB reactivation, increased risk of serious infections and sepsis, injection site reactions including erythema, itching, swelling, demyelinating disease, lymphoma.	Rule out prior tuberculosis infection with PPD and chest radiograph. CBC with differential, AST, ALT, and serum electrolytes every two weeks for the first month then every four to six weeks.
Anakinra (Kineret)	Subcutaneous	Leukopenia (with combination immunomodulator), risk of serious infections, injection site inflammation.	CBC with differential, AST, ALT and serum electrolytes every two weeks for the first month then every four to six weeks.

Lustig, M. J. and Cunningham, E. T. Use of immunosuppressive agents in uveitis. *Current Opinion in Ophthalmology* 2003;14:399–412.

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