Lupus Nephritis (LN) Treatment

Induction, Maintenance and Adjunct Medication

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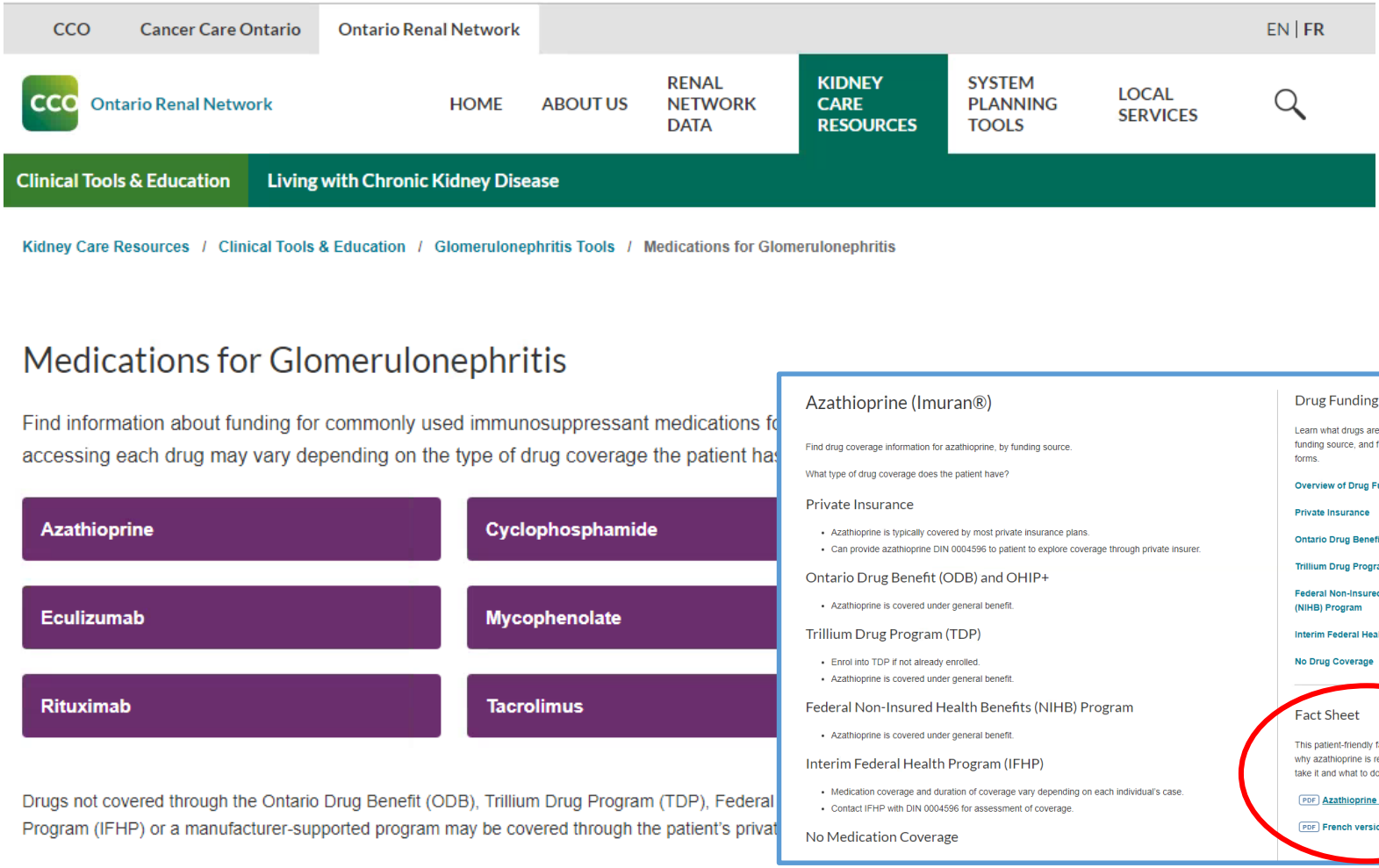
Medication Generic and Brand Names

Generic Name	Brand Name	Common Abbreviation	Renal Dose Adjustment?
Azathioprine	Imuran®	AZA	Yes
Cyclophosphamide IV	Procytox®	CYC	Yes
Cyclosporine	Neoral®	CsA	No*
Hydroxychloroquine	Plaquenil®	HCQ	Yes
Methotrexate		MTX	Yes
Methylprednisolone IV / PO	Solumedrol®, Medrol®		No
Mycophenolate Mofetil	CellCept®	MMF	No
Mycophenolate Sodium	Myfortic®		No
Prednisone			No
Rituximab IV	Rituxan®	RIX	No
Sulfamethoxazole / Trimethoprim (Co-trimoxazole)	Septra®, Bactrim®	TMP/SMX	Yes
Tacrolimus	Advagraf®, Prograf®		No*

**Renal impairment does not affect elimination or serum concentrations of tacrolimus or cyclosporine; but may cause nephrotoxicity requiring dose reduction.*

ORN Patient Information Handouts



https://www.ontariorenalnetwork.ca/en/kidney-care-resources/clinical-tools/glomerulonephritis/medications-for-glomerulonephritis

ORN Patient Information Handouts

CCO Ontario Renal Network

Corticosteroids

Information For Patient With Glomerulonephritis

Generic Name	Brand Name
Prednisone (PRED-ni-sone) Tablets	
Methylprednisolone(METH il pred NIS oh lone) Injection	Solumedrol®

What are Corticosteroids and why are they being recommended for me?

- Corticosteroids are used to control diseases of the immune system such as glomerulonephritis (inflammation of the kidneys) or vasculitis (inflammation of the blood vessels).
- They work by lowering your immune system.
- They can reduce the leakage of protein from your kidneys into the urine.

How should I take Corticosteroids?

- Corticosteroids can be taken as a tablet by mouth or can be given by intravenous (IV) infusion by a nurse. Your doctor will determine which formulation is most appropriate for you.

Prednisone Tablets

- The number of Prednisone tablets can change so make sure you are taking the correct dose.
- Prednisone should be taken once daily in the morning.
- Take Prednisone with food to prevent upset stomach.
- If you miss a dose, take the missed dose as soon as you remember. But, if it is almost time for the next dose, skip the dose you missed and take the next dose at the regular time. Do not take 2 doses at the same time.
- Do not suddenly stop taking Prednisone as your body will have become accustomed to receiving it and stopping it abruptly can cause life threatening low blood pressure in the event of stress. If you have been taking Prednisone for a long time, your doctor will slowly lower the dose so that your body gets used to receiving less Prednisone.

Methylprednisolone Infusion

- Dose and schedule of this medication are determined by your doctor.

What monitoring will I need?

- The clinic will order regular blood tests and 24 hour urine collections to check your response to Corticosteroids and to monitor for side effects.

What else do I need to know before taking Corticosteroids?

- Tell all members of your health care team that you are taking Corticosteroids or have taken Corticosteroids in the past.
- To prevent a specific, serious lung infection called pneumocystis jiroveci pneumonia (PJP), you may be prescribed an antibiotic if you are on a high dose of Corticosteroid therapy.
- Always contact the clinic before starting any new prescription and/or nonprescription medications (including vitamins and herbal products).
- Contact the clinic before receiving any vaccines. Corticosteroids may increase your chance of an infection and/or make the vaccine not work as well.

What are the possible side effects of Corticosteroids?

- All medications may cause side effects; however, many people only experience mild side effects. Additionally, side effects may vary depending on the dose and duration of therapy. They will often improve as the dose is adjusted. Contact the clinic if you have any concerns about the following possible side effects:

Side effects and what to do

	Side Effects
Most Common (10-20% of people experience)	**Increase in appetite and weight gain** • Maintaining a healthy diet and a regular exercise routine can help.
	Stomach upset • Taking Corticosteroids with food may help. • To prevent stomach upset, you may be prescribed a medication that lowers the acidity in your stomach.
	Changes in mood • This includes irritability, depression, feeling stimulated, personality changes and difficulty concentrating. • Let the clinic know if this is difficult to manage.
	Difficulty sleeping • Taking Corticosteroids in the morning will help minimize its impact on sleep.
	Increase in blood sugar (diabetes) • The clinic will monitor blood sugar levels regularly. • Adjustment or addition of diabetes medication may be needed.
	Increase in blood pressure • Monitor your blood pressure regularly. • Adjustment or addition of blood pressure medication may be needed.
	Water retention or swollen ankles • If it becomes bothersome, please contact the clinic. • Adjustment or addition of diuretic (water pill) medication may be needed.
	Puffiness or rounding of the face and cheeks • This effect tends to go away a few months after Corticosteroid therapy is stopped.
	Skin changes • This includes thinning of the skin, acne, stretch marks, bruising more easily and slower wound healing.

http://www.renalnetwork.on.ca/hcpinfo/glomerulonephritis/medication_fact_sheets_for_patients/#.W0z9di7wZhE

To learn more about The Ontario Renal Network, please visit **http://www.renalnetwork.on.ca/**

Ontario Cancer Care Ontario

Induction and Maintenance Therapy

Induction

Maintenance

Induction

(3rd line options)

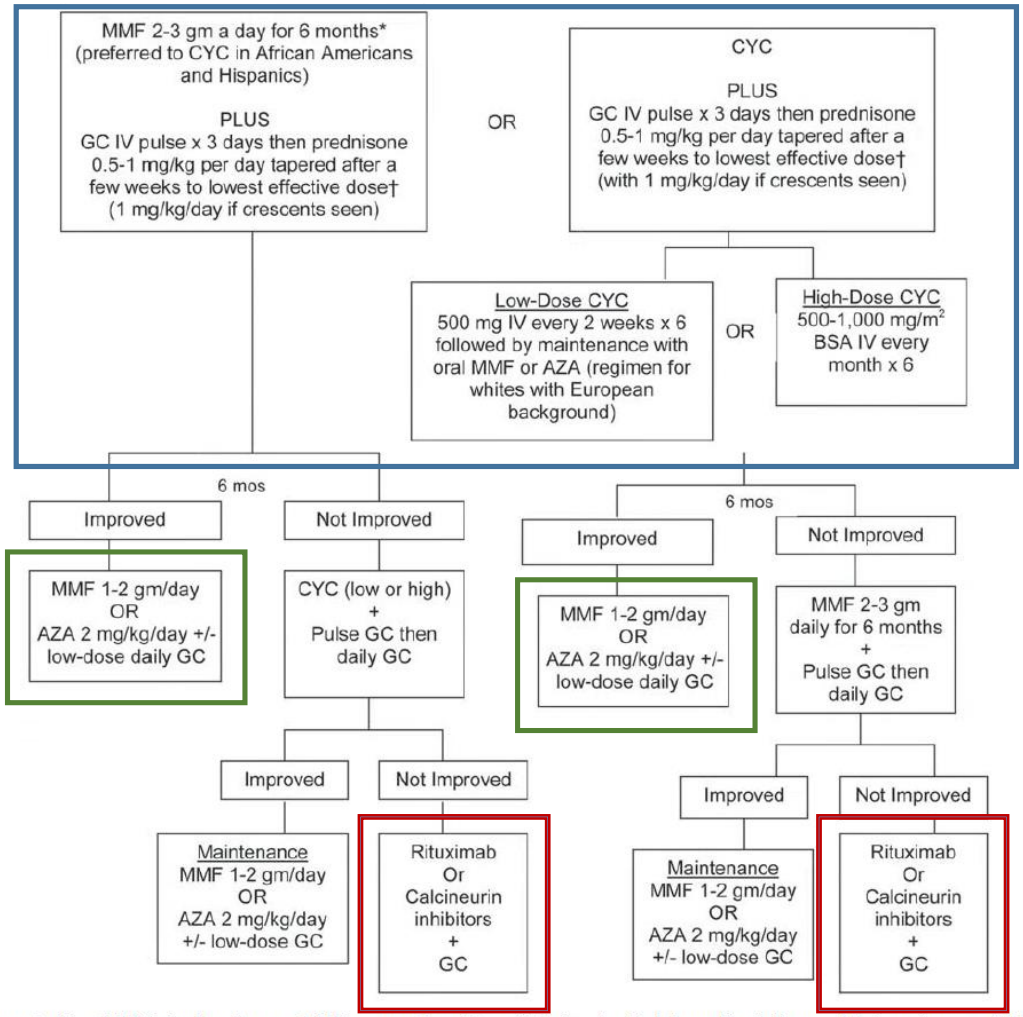


Figure 2. Class III/IV induction therapy. MMF = mycophenolate mofetil; * = the Task Force Panel discussed their preference of MMF over cyclophosphamide (CYC) in patients who desire to preserve fertility; GC = glucocorticoids; IV = intravenous; † = recommended

Patient assessment prior to 'Induction' phase of treatment

Assessment prior to therapy

1. CBC, Urea, Electrolytes, Creatinine, LFT, CRP and ESR, and urinalysis for blood & protein with results checked prior to ordering the first treatment.

2. Determine if any **contraindications** to Cyclophosphamide / MMF based immunosuppression.

   - infection (chest, throat or urine)
   - Pregnancy
   - Need / want to preserve fertility (of childbearing age)

3. Baseline pulse and blood pressure should be recorded.

4. Tb skin test, assess for risk of active or latent tuberculosis

5. Baseline viral immunity: All patients should have screening of

   - Hepatitis B and C serology
   - Varicella Zoster immunity - Those not immune =should be warned to avoid contact with infectious individuals, in case of exposure (to chicken pox, or shingles) consider prophylactic acyclovir
   - HIV status.

Sample GN Intake Flowsheet

Vaccination and Screening			Comments / Result
Recommend pre-treatment vaccinations (if serology -ve and delay acceptable) • Influenza • Pneumococcal • varicella zoster	 Y Y Y	 N N N	
TB Screening • Tuberculin skin test, if NO immunosuppression in last 3 months • CXR and Tuberculin skin test if immunosuppressed	 Y Y	 N N	
Hep B Screening (indicate if positive) • Anti-HBs (Antibody to Hep B surface) • HBsAg (Hep B surface antigen) • Anti-HBc (Antibody to Hep B core)	 Y Y Y	 N N N	 *If Anti-HBc (+) & Anti-HBs (-), may require Hep B prophylaxis
Hep C Status (indicate if positive) • Hep C Antibody	 Y	 N	
HIV Status (i			
Medical Condit			
Pregnant			
Contraception use	Y	N	* Two forms of contraception preferred (if MMF, CYC, RITUX)
Infection (Acute / Chronic)	Y	N	
Pre-treatment bloodwork (recent) on file / ordered	Y	N	
Consider / prescribe / advise on additional medications & management			Comments / Result
Gastric protection • Is pt on ranitidine, famotidine, PPI?	Y	N	
PCP Prophylaxis • TMP/SMX, Dapsone or Atovaquone	Y	N	
Bone protection • Calcium and Vit D	Y	N	
Fertility / Family planning education	Y	N	
Medication information sheets provided & discussed	Y	N	
Education provided- Avoid 'Live Vaccine' • (eg, BCG, MMR, Varicella, Zoster live)	Y	N	
Consent to treatment signed by patient	Y	N	

Induction Medication

Corticosteroids

Action: up-regulates the expression of anti-inflammatory proteins and represses the expression of pro-inflammatory proteins. It is the **fastest anti-inflammatory available**

Methylprednisolone IV (Solumedrol®)
- ***500–1,000 mg daily*** *for 3 doses then,*

Prednisone
- ***0.5–1 mg/kg/day****, followed by a taper to the minimal amount necessary to control disease*

Key Points
- Dosage should be decreased to the lowest level needed to keep disease under control
- ***Never discontinue corticosteroids abruptly*** (if have received treatment doses for > 10 days)
  - Acute adrenal insufficiency may occur (can even cause death)
  - Steroid withdrawal syndrome: lethargy, fever, myalgia following abrupt discontinuation

- **Calcium Carbonate 500mg OD + Vitamin D 400-1000 IU OD prescribed to reduce risk of steroid induced osteoporosis**
- Consider Bisphosphonates or Denosumab (Prolia®) for additional bone protection (use with caution in CKD)
- **Consider PCP prophylaxis** (discussed in later slide)
- **Gastric Protection:** H2 receptor blocker or PPI (Ranitidine or Pantoprazole) should be considered / prescribed

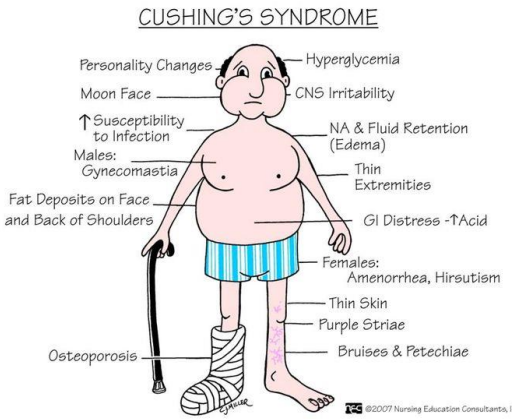
Pregnancy: considered safe

Side effects:

Short Term
- Increase appetite and weight gain
- Cushingoid (moon) face, buffalo bump
- Acne
- Mood swings and even psychosis
- Insomnia
- Osteoporosis
- Glaucoma, cataracts

Long Term
- Osteoporosis
- Glaucoma, cataracts
- Osteonecrosis

(due to reduced blood flow to bone)
- Increase risk of infection
- Gastritis and peptic ulcers
- delay wound healing



Cyclophosphamide (Procytox®)

Pharmaceutical category: Immunosuppressant / Antineoplastic (chemotherapy)
Dosing:

- **Euro lupus protocol: low dose, 500mg every 2 weeks x 6,**
  (Preferred, due similar efficacy, less side effects [infection])
- Alternative: NIH protocol: (0.5-1g/m square) monthly x 6

Side Effects:

- Bone marrow suppression
- Increase risk of infection
- Hair loss or alopecia
- ***Risk of sterility / reproductive toxicity***
- Increase of risk of malignancy (cumulative, dose dependent)
- Bladder Bleeding (AKA: Hemorrhagic cystitis) (Mesna and fluids given to reduce this risk)

Special Considerations:

- Needs to be infused by a Chemo certified nurse
- Special chemo precautions required for handling, administering, disposing
- Chemo contact precautions for 48 hours after administration

Pregnancy: Teratogenic, Fetal toxic (results in fetal loss) - Avoid

Safety monitoring – IV Cyclophosphamide

Pulsed IV **cyclophosphamide monitoring**:

- ***Check CBC prior to each infusion***
  (same day or 1-2 days prior)

- If WBC prior to infusion <4.0 or neutrophil count <2.0, then postpone infusion until WBC >4.0 and neutrophil count >2.0 while checking the CBC weekly.
  - (may consider dose reduction)

Mycophenolate
Mofetil (CellCept®) or Sodium (Myfortic®)

Pharmaceutical category: Immunosuppressant

Dosage:
- **Induction: 2 to 3 grams / day for 6 months (split BID)**
- Maintenance 0.5-2 g / day (split BID)
- Should be taken at a consistent time each day in relation to meals

Drug Interactions: Substrate of OAT3, OATP, UGT

Adverse reactions: ***Stomach upset (take with food),*** Headache, ***Myelosuppression***, Increased risk of infection, increase risk for malignancy

Safety Monitoring:
- Check CBC (Drug levels not readily available)

Key points:
- Black and Hispanic - Mycophenolate more effective than Cyclophosphamide [1]
- ***Asian patients*** should be dosed lower for induction **(2 grams daily)** [2]
- CellCept 250mg ≈ Myfortic 180mg, ***therapeutically interchangeable*** for Lupus Nephritis
- Should be taken at a consistent time each day in relation to meals

ODB Coverage: BOTH general benefit (2019 update)
Pregnancy: Teratogenic - Avoid

[1]jasn.asnjournals.org/content/20/5/1103

[2]American College of Rheumatology Guidelines for Screening, Treatment, and Management of Lupus Nephritis (2012)

Rituximab

Pharmaceutical category: Immunosuppressant, Monoclonal Antibody

Dosage: IV: 375 mg/m^2 once weekly x 4 (Diaz-Largares 2012; Melander 2009)

Role: Patients who have failed conventional therapy (CYC and MMF)It is used **for induction** in.

Side Effects:

- **Infusion reactions acute and delayed, can be fatal**. To reduce risk:
  - Give as slowly as possible
  - Give pre-meds prior to infusion
- Hepatitis B reactivation possible (always check Hep B CORE Antibody)
- Increased Risk of infection
- Prolong Cytopenias (Low blood counts) and hypogammaglobulemia (Low antibody production)
- Cardiac arrhythmias

ODB Coverage: requires EAP paper application

(Off-label for SLE use in Canada)

Pregnancy: NOT considered safe in pregnancy, controversial

(weigh benefit / risk)

Jointeffort®
A Roche Patient Assistance Program

RITUXAN® (rituximab) for GRANULOMATOSIS with POLYANGIITIS (GPA) and MICROSCOPIC POLYANGIITIS (MPA) ENROLMENT FORM

Print Form

2. Rx - PLEASE MARK CLEARLY

RITUXAN DOSING

Calculate the patient's body surface area (BSA) using weight and height.

Weight _____ kg Height _____ cm Mitte: ____ dose(s) Repeats: ____

Patient's BSA= _____

Note: The formula for calculating BSA in the RAVE clinical trial was: BSA in m^2= (Weight in kg) ^0.425 x (Height in cm) ^0.725 x 0.007184. Note: Do not round until the end of calculation.

RITUXAN DOSE AND INFUSION FREQUENCY

Weekly dose (mg)= 375 mg/m^2 x patient's BSA m^2

Ordered RITUXAN dose= Weekly dose x 4 weeks

375 mg/m^2 x _____ = _____

Ordered Dose (total over 4 weeks)

Comments: _____

Dilute RITUXAN in: ☐ 250 mL of (

Blood Pressure Meds on Hold Y ☐ N ☐ Please specify: _____

RITUXAN should be given in combination with glucocorticoids.

Sample Rituximab Protocol
(Joint Effort Program Enrollment sheet)

PRE-MEDICATIONS ☐ Pre-medications approved ☐ Approved Pre-meds checked below

← Required pre-infusion meds

- ☐ Acetaminophen 650 mg PO 15-30 minute pre infusion
- ☐ Diphenhydramine 50 mg PO 15-30 minute pre infusion
- ☐ Methylprednisolone 100 mg IV in 50 mL 0.9% sodium chloride injection, USP 15-30 min pre infusion
- ☐ Other: _____
- ☐ **Pre-medications not required**

PRN MEDICATIONS FOR INFUSION REACTIONS ☐ PRN medications approved ☐ Approved PRN meds checked below

- ☐ Acetaminophen 325-650 mg PO PRN q 4-6 hours, for pain and fever, chills
- ☐ Dimenhydrinate 25-50 mg PO/IV PRN q 4 hours, for nausea and vomiting
- ☐ Diphenhydramine 25-50 mg PO/IV/IM PRN q 4-6 hours for itching, urticaria, pruritus, hives
- ☐ Epinephrine (1:1000) 0.01 mL/kg (max. 0.5 mL) SC/IM PRN q 10-15 minutes x 2 for severe anaphylactic reaction
- ☐ Hydrocortisone 100 mg IV PRN x 1 severe allergic/anaphylactic reaction
- ☐ Oxygen via mask/nasal prongs PRN for shortness of breath, wheezing
- ☐ Other: _____
- ☐ **PRN medications not required**

Maintenance Medication

Mycophenolate
Mofetil (CellCept®) or Sodium (Myfortic®)

Pharmaceutical category: Immunosuppressant

Dosage:
- Induction: 2 to 3 grams / day for 6 months (split BID)
- **Maintenance 0.5-2 g / day (split BID)**

Drug Interactions: Substrate of OAT3, OATP, UGT

Adverse reactions: ***Stomach upset (take with food),*** Headache, ***Myelosuppression***, Increased risk of infection, increase risk for malignancy

Safety Monitoring:
- Check CBC (Drug levels no

Duplicate Slide

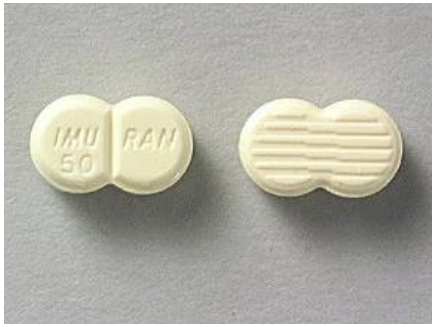
Key points:
- Black and Hispanic - Mycophenolate more effective than Cyclophosphamide [1]
- ***Asian patients*** should be dosed lower for induction **(2 grams daily)** [2]
- CellCept 250mg ≈ Myfortic 180mg, ***therapeutically interchangeable*** for Lupus Nephritis

ODB Coverage: BOTH general benefit (2019 update)
Pregnancy: Teratogenic - Avoid

[1]jasn.asnjournals.org/content/20/5/1103

[2]American College of Rheumatology Guidelines for Screening, Treatment, and Management of Lupus Nephritis (2012)

Azathioprine (Imuran®)



Pharmaceutical category: Immunosuppressant

Dosage: 2 mg/kg/day (for maintenance) up to max dose of 200mg

- may reduce to 1.5 mg/kg/day after 1 month (if proteinuria <1 g/day and SCr stable).
- Renal Dose adjustment necessary.

Drug Interactions: Avoid Allopurinol & Febuxostat (inc. serum concentration of Azathioprine), myelosuppressive / Immunosuppressive medication.

Adverse reactions:

- Hematological - Leukopenia and/or thrombocytopenia
- Gastrointestinal - Nausea and vomiting may occur initially (take after meals to reduce GI side effects).
- Less common SE: diarrhea; arthralgia, hepatotoxicity, rash, alopecia,
- avoid sun exposure and be monitored for skin cancer

Safety Monitoring for Azathioprine

- Liver Function Test
- CBC

If CBC reduced after starting AZA consider thiopurine S-methyltransferase **(TPMT) testing** (check for deficiency)

ODB Coverage: general benefit

Pregnancy Category: Considered Safe

Calcineurin Inhibitors

Two Choices

- **Tacrolimus**
  - Initially: trough 6–8 ng/mL, Long-term: trough 4–6 ng/mL or less[1]

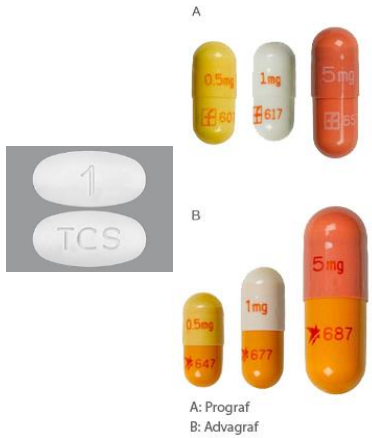
    (Opinion for low doses / long term: Monitoring of trough levels is not mandatory …can help to exclude low exposure in some patients.
- **Cyclosporine**
  - Initially: trough 150 +/-25 ng/mL, Long-term: trough level <100 ng/mL

- Indicated for nephrotic range proteinuria in pure class V (membranous) lupus nephritis
- It is also a potential alternative for induction/maintenance therapy in lupus nephritis for pregnant patients
- Many drug interactions: Extensive hepatic metabolism via CYP3A4
  - A few common examples (many many more!)

CYP 3A4 inhibitors (inc. CI concentration)	CYP 3A4 inducers (dec. CI concentration)
Diltiazem	Rifampin
Clarithromycin / Erythromycin	Phenytoin
Fluconazole	Carbamazepine
Grapefruit	St. John's Wort (herbal)

[1]https://lupus.bmj.com/content/lupusscimed/3/1/e000169.full.pdf
http://www.bcrenalagency.ca/resource-gallery/Documents/Major%20drug%20interactions%20with%20cyclosporine%20and%20tacrolimus.pdf

Tacrolimus
(Prograf®, Advagraf®, Envarsus®)



Pharmaceutical category: Immunosuppressant, Calcineurin inhibitor

Dosage: 0.1 mg/kg per day or approx. 4 to 8 mg / 24 hrs.

- Should be taken on an empty stomach

Adverse reactions:

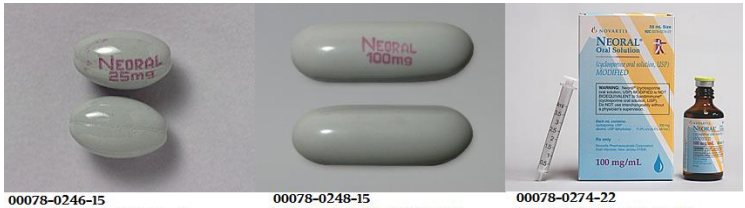
- Generally well tolerated at lower doses
- Possible: Headaches, Stomach upset, Increase in blood pressure, Hair thinning (may be reversible), Tremors or shaking of hands, changes in kidney function, Increase in potassium level, Increase in cholesterol and triglyceride levels, increased risk of infections and cancer

ODB Coverage: requires EAP paper application

Safety Monitoring:

- Check CBC, ALT / AST (for hepatotoxicity), Kidney fcn
- Drug levels required
- **Pregnancy:** Considered safe

Cyclosporine (Neoral®)



00078-0246-15
NEORAL 25 MG SGC 30 UD

00078-0248-15
NEORAL 100 MG SGC 30 UD

00078-0274-22
NEORAL ORAL SOL 50 ML

Pharmaceutical category: Immunosuppressant, Calcineurin inhibitor

Dosage: start with 2 to 4 mg/kg per day (in two divided doses) or approx. 75 to 100 mg twice daily.

- Should be taken at a consistent time each day in relation to meals

Adverse reactions:

- Headaches, Stomach upset, Increase in blood pressure, **Hair growth on face and limbs (may be reversible), gum swelling,** Tremors or shaking of hands, changes in kidney function, Increase in potassium level, Increase in cholesterol and triglyceride levels, **increase in blood sugar,** increased risk of infections and cancer

ODB Coverage: requires EAP paper application

Safety Monitoring:

- Check CBC, ALT / AST (for hepatotoxicity), Kidney fcn
- Drug levels required

Pregnancy: Considered safe

Other Adjunct Medication

PCP (PJP) Prophylaxis

Pneumocystis pneumonia (PCP) is a potentially life-threatening infection that occurs in immunocompromised individuals.

Who should receive PCP prophylaxis?

- Patients receiving a **glucocorticoid dose equivalent to ≥20 mg** of prednisone daily for one month or longer who **also have another cause of immunocompromise (eg, a second immunosuppressive drug)**

Key points:

- Every LN patient requiring induction immunosuppressive therapy requires PCP prophylaxis
- When patient's prednisone dose < 20mg daily, PCP prophylaxis may be reassessed.

PCP = PJP
The nomenclature for the species of *Pneumocystis* that infects humans has been changed from:
Pneumocystis carinii (PCP) to Pneumocystis jirovecii (PJP)

https://www.uptodate.com/contents/treatment-and-prevention-of-pneumocystis-pneumonia-in-hiv-uninfected-patients

PCP (PJP) Prophylaxis - medication

1st line regimen		
Sulfamethoxazole / Trimethoprim (Cotrimoxazole, Septra®)	1 DS tablet three times per week OR 1 SS tablet daily	Fever, rash, neutropenia, gastrointestinal upset, transaminase elevation
Alternative regimens		
2nd line regimen		
Dapsone	50 mg twice daily OR 100 mg daily	Fever, rash, gastrointestinal upset, methemoglobinemia, hemolytic anemia (check for G6PD deficiency required)
3rd line regimen		
Atovaquone suspension (Mepron®)	1500 mg orally once daily given with food	Gastrointestinal distress, rash

ODB Coverage: ALL general benefit (2019 update)

Hydroxychloroquine (Plaquenil®)

EULAR / KDIGO: "Hydroxychloroquine (HCQ) is recommended for all patients with SLE"

Action: modulates the immune system without immunosuppressing or predisposing to infection. Slow-acting drugs and it may take months for them to demonstrate a beneficial effect

- Prevent lupus from spreading to certain organs (kidney and CNS)
- Reduce flares by 50%
- Reduce mortality
- Antithrombotic effects
- Lower cholesterol

Dosing: 200 to 400 mg daily as a single daily dose or in 2 divided doses.

(do not exceed a daily dose of 5 mg/kg/day due to the risk of retinal toxicity)

Side effects: are usually rare and minor

- Stomach upset/bloating
- ***Eye toxicity-retinopathy*** ~ 1 out of 5000 patient for more than 5 years
  - See an eye doctor q12 months
- Myopathy
- Skin hyperpigmentation (reduce sun exposure / inc. sun protection)

ODB Coverage: general benefit

Pregnancy: considered safe

Methotrexate

Action: Used for skin manifestations, arthritis and modest lupus activity

Dosage: 7.5 mg once weekly

Renal Dose adjustment required

CrCl <30 mL/minute: Alert Nephrologist. Treatment decision individualized

(Typically avoided, other options available)

Side effects :

- Bone marrow suppression: reduce blood counts (reduce WBC, platelets or anemia)
- Liver toxicity
- Hair loss and oral ulcers
- Pneumonitis (cough and shortness of breath)
- Increase risk of malignancy (Lymphoma, skin Cancer and lung cancer in patients with RA and IBD)
- Diarrhea, nausea,vomiting , anorexia
- Defective spermatogenesis infertility
- Increase risk of infection

Pregnancy: Teratogenic, Fetal toxic (results in fetal loss) - Avoid

Benlysta

Pharmaceutical category: Monoclonal Antibody

Dosage: IV - Initial: 10 mg/kg every 2 weeks for 3 doses; Maintenance: 10 mg/kg every 4 weeks

Action / Indication:

- It inhibits B lymphocyte stimulator (BLyS) or B cell growth factor and thus prevents further activation and proliferation of B cells
- Improves musculoskeletal and skin manifestations
- Improves immunologic parameters (dsDNA and complement)
- Improves blood counts (platelets, anemia)

(Trials excluded patients with severe lupus nephritis or severe CNS manifestations)

Limitations of use: Use is **not recommended** in patients with severe active lupus nephritis, severe active CNS lupus, or in combination with other biologics, including B-cell targeted therapies or IV cyclophosphamide.

Side Effects:

- Nausea/diarrhea, Depression/insomnia
- Infusion reaction
- Increase risk of infection
- Muscle ache

Pregnancy: NOT considered safe in pregnancy

https://www.uptodate.com/contents/belimumab-drug-information?sectionName=Renal%20Impairment%20(Adult)&topicId=16479&search=benlysta&usage_type=panel&anchor=F50991706&source=panel_search_result&selectedTitle=1~22&kp_tab=drug_general&display_rank=1#F12617226

General Principles of Immunization of Immunocompromised Persons

- Immunocompromised persons are at increased risk from vaccine preventable diseases (VPD) and should receive appropriate vaccines.

- The degree of immunocompromise can vary from mild to profound and this, along with risk of VPD, should be taken into account when considering vaccination.

- **Live vaccines should not be given to immunocompromised persons**

  (eg, BCG, MMR, Varicella, Zoster [avoid Zostavax, Shingrix – ok])

- Non-live vaccines are safe to use. However, depending on the degree of immunocompromise, recipients may not develop an adequate protective response.

https://www.hse.ie/eng/health/immunisation/hcpinfo/guidelines/chapter3.pdf