

BC Cancer Protocol Summary for Treatment of Chronic Lymphocytic Leukemia (CLL) or Prolymphocytic Leukemia with Fludarabine, Cyclophosphamide and riTUXimab

Protocol Code

LYFCR

Tumour Group

Lymphoma

Contact Physician

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ELIGIBILITY:

FCR (LYFCR) is recommended at time of initial need for systemic treatment in patients with

- CLL/SLL or prolymphocytic leukemia
- Patients must be appropriate candidates for FCR as follows: Age less than or equal to 65 and excellent health and performance status – ECOG 0-1 with no co-morbid illness. Note that some clinical trials have used a modified Cumulative Illness Rating Scale (CIRS) score of up to 6 to help determine eligibility for FCR. While this is not a requirement, the CIRS score is provided in Appendix 1 for reference

TESTS:

- Baseline (required before first treatment): CBC & Diff, creatinine, total bilirubin, ALT, LDH
- Baseline (required, but results do not have to be available to proceed with first treatment; results must be checked before proceeding with further treatment): HBsAg, HBsAb, HBcoreAb
- Before each treatment: CBC & Diff, creatinine
- If clinically indicated: HBV viral load, ALT (see protocol [SCHBV](#))

PREMEDICATIONS:

- No premedication is required for fludarabine
- For cyclophosphamide: ondansetron 8 mg PO and dexamethasone 8 mg PO once daily pre-chemotherapy

For riTUXimab portion

- For intravenous infusion:
diphenhydramine 50 mg PO prior to riTUXimab IV and then q 4 h during the IV infusion, if the infusion exceeds 4 h
acetaminophen 650-975 mg PO prior to riTUXimab IV and then q 4 h during the IV infusion, if the infusion exceeds 4 h
- For subcutaneous injection:
diphenhydramine 50 mg PO prior to riTUXimab subcutaneous
acetaminophen 650-975mg PO prior to riTUXimab subcutaneous

SUPPORTIVE MEDICATIONS:

- Very high risk of hepatitis B reactivation. If HBsAg or HBcoreAb positive, follow hepatitis B prophylaxis as per [SCHBV](#).

TREATMENT:**CYCLE 1:**

Drug	Dose	BC Cancer Administration Guideline
fludarabine¶	40 mg/m ² /day x 3 consecutive days (Day 1-3) (round dose to nearest 10 mg)	PO Do not chew, break or crush the tablets.
cyclophosphamide‡	250 mg/m ² /day x 3 consecutive days (Day 1-3) (round dose to nearest 25 mg)	PO Dividing drug into 2-3 subdoses each day may improve tolerance
riTUXimab***†	375 mg/m ² on Day 1 NOTE: riTUXimab, cyclophosphamide and fludarabine to start on the same day.	IV in 250 to 500 mL NS over 1 hour 30 minutes to 8 hours*

CYCLES 2-6:

Drug	Dose	BC Cancer Administration Guideline
fludarabine¶	40 mg/m ² /day x 3 consecutive days (Day 1-3) (round dose to nearest 10 mg)	PO Do not chew, break or crush the tablets.
cyclophosphamide‡	250 mg/m ² /day x 3 consecutive days (Day 1-3) (round dose to nearest 25 mg)	PO Dividing drug into 2-3 subdoses each day may improve tolerance
riTUXimab***†	500 mg/m ² on Day 1 NOTE: riTUXimab, cyclophosphamide and fludarabine to start on the same day.	IV in 250 to 500 mL NS over 1 hour 30 min to 8 hours*
	If IV infusion tolerated (no severe reactions requiring early termination), subsequent doses can be given by subcutaneous administration	
	1600 mg (fixed dose in 13.4 mL) on Day 1 NOTE: riTUXimab, cyclophosphamide and fludarabine to start on the same day.	Subcutaneous over 7 minutes into abdominal wall‡ Observe for 15 minutes after administration

¶ If PO fludarabine and / or cyclophosphamide is not practical, substitute IV fludarabine and / or cyclophosphamide according to the following schedule:

Drug	Dose	BC Cancer Administration Guideline
fludarabine	25 mg/m ² /day x 3 consecutive working weekdays (Day 1-3) NOTE: riTUXimab to be given within 72 h of IV fludarabine and cyclophosphamide	IV in 100 mL NS over 30 minutes
cyclophosphamide	250 mg/m ² /day x 3 consecutive working weekdays (Days 1-3)	IV in 100 mL NS over 20 minutes to 1 hour

*Start the riTUXimab (first dose) initial infusion at 50 mg/h and, after 1 hour, increase by 50 mg/h every 30 minutes until a rate of 400 mg/h is reached. For all subsequent treatments, infuse 50 mL of 250 mL bag (or 100 mL of 500 mL bag) of the dose over 30 minutes then infuse the remaining 200 mL of 250 mL bag (or 400 mL of 500 mL bag) (4/5) over 1 hour (total infusion time = 1 hour 30 minutes). Development of an allergic reaction may require a slower infusion rate. See hypersensitivity below.

** The risk of cytokine release syndrome is low but is increased when the peripheral blood lymphocyte count is greater than $30 \text{ to } 50 \times 10^9/\text{L}$. While there is no requirement to withhold riTUXimab based on the lymphocyte count, clinicians may wish to pre-medicate patients with high tumour burden with steroids prior to riTUXimab infusion or omit the riTUXimab from the first cycle of treatment.

†Patients must receive first dose by IV infusion (using the IV formulation) because the risk of reactions is highest with the first infusion. IV administration allows for better management of reactions by slowing or stopping the infusion. **IV first dose should also be given to patients previously treated more than 6 months ago.**

‡During treatment with subcutaneous riTUXimab, administer other subcutaneous drugs at alternative injection sites whenever possible. **If restarting more than 6 months from prior subcutaneous rituximab, give first dose by IV infusion (using the IV formulation).**

Repeat every 28 days to a maximum of 6 cycles.

DOSE MODIFICATIONS:

1. Hematologic:

ANC (x 10 ⁹ /L)*		Platelets (x 10 ⁹ /L)*	Fludarabine, cyclophosphamide and riTUXimab
less than 1.0	OR	less than 100	Delay until count recovery*

*Consider decreasing fludarabine and cyclophosphamide by 25% each for subsequent cycles, after delay following count recovery. No dose reduction required if decreased counts are due to disease.

2. **Renal Dysfunction:** For any patient with a serum creatinine above normal and for all patients above the age of 60 years, a creatinine clearance should be measured or calculated using the following formula to determine the initial dose of fludarabine.

Estimated creatinine clearance (in mL/minute) =

For men: $[1.23 \times (140 - \text{age in y})(\text{weight in kg})] \div \text{serum creatinine in micromol/L}$

For women: $[1.04 \times (140 - \text{age in y})(\text{weight in kg})] \div \text{serum creatinine in micromol/L}$

Creatinine Clearance (mL/min)	Dose	Fludarabine Actual Dose and Schedule	
		PO	IV
greater than or equal to 70	100%	40 mg/m ² /day x 3 days	25 mg/m ² /day x 3 days
30 to less than 70	50%	20 mg/m ² /day x 3 days	15 mg/m ² /day x 3 days
less than 30	DO NOT USE		

After the first cycle, it is not necessary to re-calculate the creatinine clearance or to re-adjust the fludarabine or cyclophosphamide dose unless the serum creatinine is above the normal range. If this occurs, use the above calculation and dose modification table.

If a reduced dose of fludarabine was used for initial treatment and well tolerated it may be appropriate for the dose to be increased in subsequent cycles regardless of renal function. This decision must be individualized by the treating oncologist and cannot be reduced to a formula.

PRECAUTIONS:

- Neutropenia:** Fever or other evidence of infection must be assessed promptly and treated aggressively. A very high risk of hematologic toxicity including neutropenia, febrile episodes and infection (bacterial) has been reported with use of FCR. Patients should be counselled to seek medical attention promptly for fever or symptoms of infection.
Prophylaxis with cotrimoxazole DS 1 tab po BID every Monday and Thursday for pneumocystis and with valacyclovir 500 mg PO daily for VZV/HSV reactivation is recommended. Prophylaxis should be continued for three months after completion of therapy.
- Tumor Lysis Syndrome:** Prophylaxis for tumour lysis syndrome with allopurinol 300 mg daily is recommended for cycle 1. The need for allopurinol beyond cycle 1 to be determined by the treating physician.
- Need for irradiated blood products:** potentially life-threatening transfusion-related graft-versus-host-disease has been described in patients actively receiving fludarabine. The Canadian Blood Service recommends that patients on fludarabine should receive irradiated blood products, effectively eliminating this risk.
- Hepatitis B Reactivation:** See [SCHBV protocol](#) for more details.
- Hypersensitivity:** Refer to BC Cancer Hypersensitivity Guidelines. RiTUXimab can cause allergic type reactions during the IV infusion such as hypotension, wheezing, rash, flushing, alarm, pruritus, sneezing, cough, fever or faintness. For the first dose, patients are to be under constant visual observation during all dose increases and for 30 minutes after infusion is completed. For all subsequent doses, constant visual observation is not required. Vital signs are not required unless symptomatic. Because transient hypotension may occur during infusion, consider withholding antihypertensive medications 12 hours prior to riTUXimab infusion. If an allergic reaction occurs, stop the infusion and the physician in charge should determine a safe time and rate to resume the infusion. A reasonable guideline is as follows. After recovery of symptoms, restart riTUXimab infusion at one infusion rate below the rate at which the reaction occurred and continue with escalation of infusion rates on the appropriate schedule above. If the infusion must be stopped a second time, restart after clearance of symptoms, at one infusion rate lower and continue at that rate without further escalation. Fatal cytokine release syndrome can occur (see below).
- Fatal Cytokine Release Syndrome** has been reported. It usually occurs within 1-2 hours of initiating the first riTUXimab infusion. Initially, it is characterised by severe dyspnea (often with bronchospasm and hypoxia) in addition to fever, chills, rigors, urticaria and angioedema. Pulmonary interstitial infiltrates or edema visible on chest x-ray may accompany acute respiratory failure. There may be features of tumour lysis syndrome such as hyperuricemia, hypocalcemia, acute renal failure and elevated LDH. For severe reactions, stop the infusion immediately and evaluate for tumour lysis syndrome and pulmonary infiltration. Aggressive symptomatic treatment is required. The infusion can be resumed at no more than one-half the previous rate once all symptoms have resolved, and

laboratory values and chest x-ray findings have normalized. If the total WBC greater than $30 \times 10^9/L$ RiTUXimab should be omitted from the first cycle of treatment to avoid risk of massive cytokine release syndrome. RiTUXimab can be incorporated in subsequent cycles of treatment regardless of the level of the WBC count.

7. **Rare Severe Mucocutaneous Reactions:** (similar to Stevens-Johnson Syndrome) have been anecdotally reported. If such a reaction occurs, RiTUXimab should be discontinued.
8. **Gastrointestinal Obstruction or Perforation:** There have been rare reports of gastrointestinal obstruction or perforation, sometimes fatal, when RiTUXimab is given in combination with other chemotherapy, occurring 1 to 12 weeks after treatment. Symptoms possibly indicative of such complications should be carefully investigated and appropriately treated.
9. **Medication Safety:** RiTUXimab is formulated differently for IV versus subcutaneous administration. Use caution during prescribing, product selection, preparation and administration. IV formulation is supplied as 10 mg/mL solution which must be diluted prior to administration. Subcutaneous formulation is supplied as a fixed dose of 1400 mg/11.7 mL or 1600mg/13.4mL ready-to-use solution which contains hyaluronidase to facilitate injection.
10. **Increased drug absorption by hyaluronidase:** other subcutaneous medications should not be injected at the same site as subcutaneous RiTUXimab. Increased systemic effects are unlikely to be clinically significant with topical applications of EMLA, hydrocortisone, or diphenhydramine.

Call Dr. Laurie H. Sehn, Dr. Alina Gerrie or tumour group delegate at (604) 877-6000 or 1-800-663-3333 with any problems or questions regarding this treatment program.

References:

1. Hallek M, et al. Addition of rituximab to fludarabine and cyclophosphamide in patients with chronic lymphocytic leukaemia: a randomised, open-label, phase 3 trial. *Lancet* 2010;376:1164-74.
2. Keating MJ, et al. Early results of a chemoimmunotherapy regimen of fludarabine, cyclophosphamide, and rituximab as initial therapy for chronic lymphocytic leukemia. *J Clin Oncol* 2005;23:4079-88.
3. Fink A, et al. Chemoimmunotherapy with fludarabine (F), cyclophosphamide (C), and rituximab (R) (FCR) versus bendamustine and rituximab (BR) in previously untreated and physically fit patients (pts) with advanced chronic lymphocytic leukemia (CLL): results of a planned interim analysis of the CLL10 Trial, an international, randomized study of the German CLL Study Group (GCLLSG) ASH Abstracts Blood 2013;122:526.
4. Robak T, et al. Rituximab plus fludarabine and cyclophosphamide prolongs progression-free survival compared with fludarabine and cyclophosphamide alone in previously treated chronic lymphocytic leukemia. *J Clin Oncol* 2010;28:1756-65.
5. Badoux XC, et al. Fludarabine, cyclophosphamide, and rituximab chemoimmunotherapy is highly effective treatment for relapsed patients with CLL. *Blood* 2011;117:3016-24.
6. Wierda W, et al. Chemoimmunotherapy with fludarabine, cyclophosphamide, and rituximab for relapsed and refractory chronic lymphocytic leukemia. *J Clin Oncol* 2005;23:4070-8.
7. Del Giudice I, et al. Chronic lymphocytic leukemia in less fit patients: "slow-go". *Leuk Lymphoma* 2011;52:2207-16.
8. Cheng MM, et al. A network meta-analysis of therapies for previously untreated chronic lymphocytic leukemia. *Cancer Treat Rev* 2012;38(8):1004-11.
9. O'Brien SM, Kantarjian H, Thomas DA, et al: Rituximab dose-escalation trial in chronic lymphocytic leukemia. *J Clin Oncol* 2001;19(8):2165-70.

Appendix 1: Cumulative Illness Rating Scale (CIRS)*

Systems (examples, not limited to)	Score (0-4)
Cardiovascular/Respiratory	----
Cardiac (angina, myocardial infarction, arrhythmia, valve problems)	
Hypertension (rating based on severity)	
Vascular (cholesterol, peripheral atherosclerotic disease, abdominal aortic aneurysm, surgery)	
Respiratory (asthma, emphysema, PE, smoking: ≤ 20 pack years = 1; 21-40 = 2; > 40 = 3)	
Eye, ear, nose, throat, larynx (corrective lenses, glaucoma, cataracts, hearing impairment)	
Gastrointestinal	----
Upper gastrointestinal tract (indigestion/GERD, stomach, duodenal problems)	
Lower gastrointestinal tract (intestinal hernias, constipation, anal problems, incontinence)	
Hepatic and pancreatic diseases (hepatic or pancreatic problems, cholecystectomy)	
Genitourinary system	----
Renal (impairment in function, infection)	
Other genitourinary (lithiasis, incontinence)	
Musculoskeletal/Cutaneous	----
Muscle, bone and skin diseases (osteoarthritis, carpal tunnel, other skin/MSK problem)	
Neuropsychiatric	----
Neurological (stroke, headache, seizures, peripheral neuropathy)	
Psychiatric (depression, anxiety, alcohol/drug abuse, dementia, sleep disorders)	
Endocrine and Metabolic	----
Endocrine and metabolic diseases (thyroid, osteoporosis, obesity: BMI ≥ 30 = 1; BMI ≥ 45 = 3, diabetes, hormonal problem, symptomatic menopausal)	
TOTAL SCORE	

CIRS Severity Rating
0 No problem affecting that system
1 Current mild problem, does not interfere with normal activity, or past significant problem
2 Interferes with normal activity and/or requires first-line therapy
3 Severe problem and/or constant and significant disability and/or hard to control chronic problem
4 Extremely severe problem and/or treatment is urgent and/or severe functional impairment or organ failure

* Adapted from Parmelee, PA, Thuras PD, Katz IR et al. Validation of the Cumulative Incidence Rating Scale in a geriatric residential population. J Am Geriatr Soc 1995;43(3):130-7.