NCCP Chemotherapy Regimen

(*Rituximab) Cyclophosphamide, DOXOrubicin, VinCRIStine and Prednisolone (*R)-CHOP Therapy– 21 days

INDICATIONS FOR USE:

<table>
<thead>
<tr>
<th>INDICATION</th>
<th>ICD10</th>
<th>Regimen Code</th>
<th>Reimbursement Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment of non hodgkins lymphoma (NHL)*</td>
<td>C85</td>
<td>00307a</td>
<td>Hospital</td>
</tr>
</tbody>
</table>

*Rituximab to be included in CD20 positive patients

TREATMENT:

The starting dose of the drugs detailed below may be adjusted downward by the prescribing clinician, using their independent medical judgement, to consider each patient's individual clinical circumstances.

Treatment is administered every 21 days for a maximum of 8 cycles or until disease progression or unacceptable toxicity develops.

Facilities to treat anaphylaxis MUST be present when the chemotherapy is administered.

<table>
<thead>
<tr>
<th>Day</th>
<th>Drug</th>
<th>Dose</th>
<th>Route</th>
<th>Diluent &amp; Rate</th>
<th>Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RitUXimab (CD20+ patients only)</td>
<td>375mg/m^2</td>
<td>IV infusion^4</td>
<td>500ml 0.9% sodium chloride at a maximum rate of 400mg/hr^1</td>
<td>1-8</td>
</tr>
<tr>
<td>1</td>
<td>Cyclophosphamide</td>
<td>750mg/m^2</td>
<td>IV infusion^4</td>
<td>250 mL 0.9% NaCl over 30 minutes</td>
<td>1-8</td>
</tr>
<tr>
<td>1</td>
<td>DOXOrubicin^5</td>
<td>50mg/m^2</td>
<td>IV Bolus</td>
<td>Into the side arm of a fast running 0.9% NaCl infusion</td>
<td>1-8</td>
</tr>
<tr>
<td>1</td>
<td>VinCRIStine^4</td>
<td>1.4mg/m^2 (Max 2mg)</td>
<td>IV infusion</td>
<td>50ml minibag 0.9% NaCl over 15minutes</td>
<td>1-8</td>
</tr>
<tr>
<td>1-5</td>
<td>Prednisolone</td>
<td>100mg(**)</td>
<td>PO</td>
<td></td>
<td>1-8</td>
</tr>
</tbody>
</table>

^1 See table 1: Guidance for administration of ritUXimab

^2 Cyclophosphamide may also be administered as an IV bolus over 5-10mins

^3 Lifetime cumulative dose of DOXOrubicin is 450mg/m^2

In establishing the maximal cumulative dose of an anthracycline, consideration should be given to the risk factors outlined below and to the age of the patient.

^4 VinCRIStine is a neurotoxic chemotherapeutic agent.

Refer to NCCP Guidance on the Safe Use of Neurotoxic drugs (including Vinca Alkaloids) in the treatment of cancer Here

** Alternative steroid regimens may be used at consultant discretion

Table 1: Guidance for administration of ritUXimab
The recommended initial rate for infusion is 50 mg/hr; after the first 30 minutes, it can be escalated in 50 mg/hr increments every 30 minutes, to a maximum of 400 mg/hr.

Subsequent infusions can be infused at an initial rate of 100 mg/hr, and increased by 100 mg/hr increments at 30 minute intervals, to a maximum of 400 mg/hr.

Development of an allergic reaction may require a slower infusion rate. See Hypersensitivity/Infusion reactions under Adverse Effects/Regimen Specific Complications below.

Any deviation from the advised infusion rate should be noted in local policies.

Rapid rate infusion schedule  
See NCCP guidance here
If patients did not experience a serious infusion related reaction with their first or subsequent infusions of a dose of riTUXimab administered over the standard infusion schedule, a more rapid infusion can be administered for second and subsequent infusions using the same concentration as in previous infusions. Initiate at a rate of 20% of the total dose for the first 30 minutes and then 80% of the dose for the next 60 minutes (total infusion time of 90 minutes). If the more rapid infusion is tolerated, this infusion schedule can be used when administering subsequent infusions.

Patients who have clinically significant cardiovascular disease, including arrhythmias, or previous serious infusion reactions to any prior biologic therapy or to riTUXimab, should not be administered the more rapid infusion.

ELIGIBILITY:
- Indications as above
- Adequate haematological, renal and liver status

EXCLUSIONS:
- Hypersensitivity to DOXorubicin, cyclophosphamide, vinCRIStine sulphate, prednisolone, riTUXimab or any of the excipients.
- A cumulative life-long dose of 450mg/m2 of DOXorubicin should only be exceeded with extreme caution as there is as risk of irreversible congestive heart failure
- Active, severe infections (e.g. tuberculosis, sepsis and opportunistic infections)
- Patients in a severely immunocompromised state
- Pregnancy or Lactation.

PRESCRIPTIVE AUTHORITY:
The treatment plan must be initiated by a Consultant Medical Oncologist or by a Consultant Haematologist working in the area of haematological malignancies.

TESTS:
Baseline tests:
- FBC, renal and liver profile
- ECG
- MUGA or ECHO should be considered prior to the administration of DOXorubicin
- LDH, Uric acid, SPEP
- Virology screen -Hepatitis B (HbsAg, HBcoreAb) & C, HIV*
  *See Adverse Effects/Regimen Specific Complications
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Regular tests:
- FBC, renal and liver profile and LDH prior to each cycle
- Evaluate for peripheral neuropathy prior to each cycle
- MUGA or ECHO as clinically indicated

Disease monitoring:
Disease monitoring should be in line with the patient’s treatment plan and any other test/s as directed by the supervising Consultant.

DOSE MODIFICATIONS:
- Any dose modification should be discussed with a Consultant.
- No dose reductions of ritUXimab are recommended.
- Consider vinCRISTine dose reduction in elderly patients

Haematological:
Table 2: Dose modification in haematological toxicity

<table>
<thead>
<tr>
<th>ANC (x10⁹/L)</th>
<th>Platelets (x10⁹/L)</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 and/or &lt; 75</td>
<td></td>
<td>Delay treatment until recovery. Consider treatment delay and/or add G-CSF adding G-CSF.</td>
</tr>
</tbody>
</table>

Renal and Hepatic Impairment:
Table 3: Recommended dose modification in Renal and Hepatic Impairment:

<table>
<thead>
<tr>
<th>Drug</th>
<th>Renal impairment</th>
<th>Hepatic impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>RitUXimab</td>
<td>No dose adjustment necessary</td>
<td>No dose adjustment necessary</td>
</tr>
<tr>
<td>Cyclophosphamide</td>
<td></td>
<td>Severe impairment: Clinical decision</td>
</tr>
<tr>
<td>CrCl (ml/min)</td>
<td>Dose</td>
<td></td>
</tr>
<tr>
<td>&gt;20</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>10-20</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>&lt;10</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>DOXOrubicin</td>
<td>No dose reduction required. Clinical decision in severe impairment</td>
<td></td>
</tr>
<tr>
<td>Bilirubin (micromole/L)</td>
<td>Dose</td>
<td></td>
</tr>
<tr>
<td>20-51</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>51-85</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>&gt;85</td>
<td>Omit</td>
<td></td>
</tr>
<tr>
<td>If AST 2-3 x ULN give 75% dose</td>
<td>If AST &gt; 3 x ULN give 50% dose</td>
<td></td>
</tr>
</tbody>
</table>

| VinCRISTine | No dose reduction required | |
| Bilirubin (micromol/L) | AST/ALT | Dose |
| 26-51 | or 60-180 | 50% |
| >51 | and Normal | 50% |
| >51 | and >180 | Omit |

The information contained in this document is a statement of consensus of NCCP and ISMO or IHS professionals regarding their views of currently accepted approaches to treatment. Any clinician seeking to apply or consult these documents is expected to use independent medical judgement in the context of individual clinical circumstances to determine any patient’s care or treatment. Use of these documents is the responsibility of the prescribing clinician and is subject to HSE’s terms of use available at [http://www.hse.ie/eng/Disclaimer](http://www.hse.ie/eng/Disclaimer). This information is valid only on the day of printing, for any updates please check [www.hse.ie/NCCPchemoregimens](http://www.hse.ie/NCCPchemoregimens)
Management of adverse events:

Table 4: Recommended dose modification based on adverse events

<table>
<thead>
<tr>
<th>Adverse reactions</th>
<th>Recommended dose modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rituximab Severe infusion related reaction (e.g. dyspnoea, bronchospasm, hypotension or hypoxia) First occurrence</td>
<td>Interrupt infusion immediately. Evaluate for cytokine release/tumour lysis syndrome (appropriate laboratory tests) and pulmonary infiltration (chest x-ray). Infusion may be restarted on resolution of all symptoms, normalisation of laboratory values and chest x-ray findings at no more than one-half the previous rate.</td>
</tr>
<tr>
<td>Second occurrence</td>
<td>Consider coverage with steroids for those who are not already receiving steroids. Consider discontinuing treatment</td>
</tr>
<tr>
<td>Mild or moderate infusion-related reaction</td>
<td>Reduce rate of infusion. The infusion rate may be increased upon improvement of symptoms</td>
</tr>
<tr>
<td>VinCRIStine Neurotoxicity*</td>
<td></td>
</tr>
<tr>
<td>Grade 1</td>
<td>100%</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Hold until recovery then reduce dose by 50%</td>
</tr>
<tr>
<td>Grade 3-4</td>
<td>Omit</td>
</tr>
</tbody>
</table>

*Common Terminology Criteria for Adverse Events (CTCAE) version 4.0.

SUPPORTIVE CARE:

EMETOGENIC POTENTIAL:

Moderate. (Refer to local policy).

PREMEDICATIONS:

Premedication consisting of an anti-pyretic and an anti-histamine should always be administered before each infusion of riTUXimab.

Table 5: Suggested pre-medications prior to riTUXimab infusion:

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Dose</th>
<th>Route</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paracetamol</td>
<td>1g</td>
<td>PO 60 minutes prior to riTUXimab infusion</td>
</tr>
<tr>
<td>Chlorphenamine</td>
<td>10mg</td>
<td>IV bolus 60 minutes prior to riTUXimab infusion</td>
</tr>
</tbody>
</table>

Ensure glucocorticoid component of the treatment regimen (prednisolone 100mg) is given at least 30 minutes prior to rituximab infusion

OTHER SUPPORTIVE CARE:

- Prophylactic regimen against vinCRIStine induced constipation is recommended (Refer to local policy).
- G-CSF prophylaxis may be required,
- Tumour lysis syndrome prophylaxis (Refer to local policy)
- Anti-viral prophylaxis (Refer to local policy)
- Anti-fungal prophylaxis (Avoid the concurrent use of azoles and vinCRIStine (Refer to local policy)
- Proton-Pump inhibitor during steroid treatment (Refer to local policy).
- PJP prophylaxis (refer to local policy)
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- Patients should have an increased fluid intake of 2-3 litres on day 1 and 2 to prevent haemorrhagic cystitis associated with cyclophosphamide.

ADVERSE EFFECTS / REGIMEN SPECIFIC COMPLICATIONS
The adverse effects listed are not exhaustive. Please refer to the relevant Summary of Product Characteristics for full details.

- Neutropenia: Fever or other evidence of infection must be assessed promptly and treated appropriately
- Hepatitis B Reactivation: Patients should be tested for both HBsAg and HBcoreAb as per local policy. If either test is positive, such patients should be treated with anti-viral therapy. (Refer to local infectious disease policy). These patients should be considered for assessment by hepatology.

RiTUXimab
- Hepatitis B Reactivation: This has been reported in patients receiving riTUXimab including fulminant hepatitis with fatal outcome
- Hypersensitivity/Infusion Reactions: Close monitoring is required throughout the first infusion. (Refer to local policy). RiTUXimab can cause allergic type reactions during the IV infusion such as hypotension, wheezing, rash, flushing, pruritis, sneezing, cough, fever or faintness.
- Cardiac Disorders: Patients with a history of cardiac disease and/or cardiotoxic chemotherapy should be monitored closely while on riTUXimab
- Severe Cytokine Release syndrome: Usually occurs within 1 to 2 hours of initiating the first infusion. This syndrome may be associated with some features of cytokine release/tumour lysis syndrome such as hyperuricaemia, hyperkalaemia, hypocalcaemia, hyperphosphatemia, acute renal failure, elevated lactate dehydrogenase (LDH) and may be associated with acute respiratory failure and death.
  - Pulmonary interstitial infiltrates or oedema visible on chest x-ray may accompany acute respiratory failure.
  - 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.
- Severe Mucocutaneous Reactions: These include Steven Johnson syndrome and toxic epidermal necrolysis. Discontinue in patients who develop a severe mucocutaneous reaction. The safety of readministration has not been determined.
- Progressive multifocal leukoencephalopathy (PML): Use of riTUXimab may be associated with an increased risk of PML. Patients must be monitored for any new or worsening neurological symptoms. The physician should be particularly alert to symptoms suggestive of PML that the patient may not notice (e.g. cognitive, neurological or psychiatric symptoms). Patients should also be advised to inform their partner or caregivers about their treatment, since they may notice symptoms that the patient is not aware of. If a patient develops PML, the dosing of rituximab must be permanently discontinued.
- Infections: RiTUXimab should not be administered to patients with an active, severe infection. Caution should be exercised when considering the use of rituximab in patients with a history of recurring or chronic infections or with underlying conditions which may further predispose patients to serious infections. Consideration should be given to the use of antimicrobial prophylaxis.
• **Vaccines:** The safety of immunisation with live viral vaccines following rituximab therapy has not been studied. Therefore vaccination with live virus vaccines is not recommended whilst on rituximab or whilst peripherally B cell depleted. Patients treated with riTUXimab may receive non-live vaccinations

**VinCRIStine**

• **Neuropathy:** VinCRIStine may cause peripheral neuropathy which is dose related and cumulative, requiring monitoring before each dose is administered. The presence of pre-existing neuropathies or previous treatment with other neurotoxic drugs may increase risk of peripheral neuropathy. Patients with mild peripheral neuropathy can usually continue to receive full doses of vinCRIStine, but when symptoms increase in severity and interfere with neurologic function, dose reduction or discontinuation of the drug may be necessary. The natural history following discontinuation of treatment is gradual improvement, which may take up to several months. A routine prophylactic regimen against constipation is recommended for all patients receiving vinCRIStine sulphate. Paralytic ileus may occur. The ileus will reverse itself upon temporary discontinuance of vinCRIStine and with symptomatic care.

• **Extravasation:** VinCRIStine and DOXOrubicin causes pain and possible tissue necrosis if extravasated. (Refer to local policy).

**Drug interactions:**

• Antihypertensives: Additive effect of hypotension during riTUXimab infusion. Consider withholding antihypertensives 12 hours before and during riTUXimab infusion.

• DOXOrubicin cardiotoxicity is enhanced by previous or concurrent use of other anthracyclines, or other potentially cardiotoxic drugs (e.g. 5-FU, cyclophosphamide or paclitaxel) or with products affecting cardiac function (e.g. calcium antagonists).

• Current drug interaction databases should be consulted for more information including potential for interactions with CYP3AR inhibitors/inducers

**ATC CODE:**

<table>
<thead>
<tr>
<th>Drug</th>
<th>ATC Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclophosphamide</td>
<td>L01AA01</td>
</tr>
<tr>
<td>VinCRIStine</td>
<td>L01CA02</td>
</tr>
<tr>
<td>DOXOrubicin</td>
<td>L01DB01</td>
</tr>
<tr>
<td>RiTUXimab</td>
<td>L01XC02</td>
</tr>
</tbody>
</table>

**REFERENCES:**


Comments and feedback welcome at oncologydrugs@cancercontrol.ie.

1 Cardiotoxicity is a risk associated with anthracycline therapy that may be manifested by early (acute) or late (delayed) effects.
Risk factors for developing anthracycline-induced cardiotoxicity include:
• high cumulative dose, previous therapy with other anthracyclines or anthracenediones
• prior or concomitant radiotherapy to the mediastinal/pericardial area
• pre-existing heart disease
• concomitant use of other potentially cardiotoxic drugs
In establishing the maximal cumulative dose of an anthracycline, consideration should be given to the risk factors above and to the age of the patient
The rapid infusion is an unlicensed means of administration of rituximab for the indications described above, in Ireland. Patients should be informed of this and consented to treatment in line with the hospital's policy on the use of unlicensed medication and unlicensed or “off label” indications. Prescribers should be fully aware of their responsibility in communicating any relevant information to the patient and also ensuring that the unlicensed or “off label” means of administration has been acknowledged by the hospital’s Drugs and Therapeutics Committee, or equivalent, in line with hospital policy.