Nelarabine/Cyclophosphamid/Etoposide (Nel-Cyc-Etop)

INDICATION
Salvage therapy for Refractory T-cell acute lymphoblastic leukaemia or T-cell lymphoblastic non-Hodgkin's lymphoma

Nelarabine is accessed via the Cancer Drugs Fund- requires Bluteq application.

TREATMENT INTENT
Curative

PRE-ASSESSMENT

1. Blood tests - FBC, coagulation screen, U&Es, LDH, ESR, urate, calcium, magnesium, creatinine, LFTs, glucose, Igs, β2microglobulin, hepatitis B core antibody, hepatitis BsAg, hepatitis C antibody, EBV, CMV, VZV, HIV 1+2 after consent
2. Send a "group and save" sample to transfusion and inform patient and transfusion laboratory that they will require irradiated blood products for all future transfusions. Ensure irradiation card is attached to the patient's notes and copy given to the patient.
3. Ensure histology and diagnosis are confirmed prior to administration of chemotherapy and document in notes
4. Assess for CNS involvement.
5. Nelarabine can be associated with neurological complications so be cautious in patients with other neurological problems prior to therapy.
6. Record stage of disease
7. Urine pregnancy test - before cycle 1 of each new chemotherapy course in women aged 12 – 55 years of age unless they have been sterilised or undergone a hysterectomy
8. Record performance status (WHO/ECOG)
9. Record height and weight (also needed to calculate CrCl)
10. Consent - ensure patient has received adequate verbal and written information regarding their disease, treatment and potential side effects. Document in medical notes all information that has been given. Obtain written consent on the day of treatment
11. Fertility - it is very important the patient understands the potential risk of infertility, all patients should be offered fertility advice (see Fertility Guidelines)
12. Hydration - refer to Tumour Lysis protocol
Myeloid group

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**DRUG REGIMEN**

**Encourage 3L oral fluids daily**

**Days 1 to 5**
- **ETOPOSIDE** 100mg/m² daily in 1000ml Sodium Chloride 0.9% IVI over 1 hour
- **CYCLOPHOSPHAMIDE** 440mg/m² daily in 250ml Sodium Chloride 0.9% IVI over 30 minutes

**Days 7 to 11**
- **NELARABINE** 650mg/m² daily intravenous infusion over 1 hour

*The second part of the regimen with Nelarabine can be given on Days 8 to 12. Nelarabine has 8 hours expiry

**Note on regimen schedule:** This treatment can be given in reverse sequential order of the two parts of the regimen (i.e. Nelarabine on Days 1-5, and Cyclo/Etop on Days 7-11 or 8-12). There must always be 1 or 2 days gap separating administration of the two parts of the regimen.

**INTRATHECAL** administration if indicated MUST BE given NO LESS than 6 days prior to starting nelarabine or 2 days following completion of nelarabine due to increased risk of neurotoxicity.

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**CYCLE FREQUENCY**

Every 21 days. Usually only 1 – 2 cycles will be given. If partial response, a 2nd cycle may be given.

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**DOSE MODIFICATIONS**

**Haematological Toxicity**

Before each cycle, neutrophils should be >0.75 x10⁹/L and platelets should be >75 x10⁹/L unless low counts are due to bone marrow disease. Please note that in the series of Commander et al., from the start of therapy median neutrophil recovery was 25 days and median platelet recovery was 21 days.

**Neurological Toxicity**

Nelarabine must be discontinued at the first sign of neurological events of National Cancer Institute Common Terminology Criteria Adverse Event (NCI CTCAE) grade 2 or greater. Discuss with consultant.
Renal / Hepatic Impairment

Nelarabine - discuss with consultant

<table>
<thead>
<tr>
<th>Renal impairment</th>
<th>Hepatic impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not studied. Nelarabine and its active metabolite are partially renally excreted. Monitor closely for toxicity if CrCl &lt;50mL/min.</td>
<td>Not studied. Use with caution.</td>
</tr>
</tbody>
</table>

Etoposide - discuss with consultant

<table>
<thead>
<tr>
<th>Renal impairment</th>
<th>Hepatic impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrCl &gt;50ml/min 100% dose</td>
<td>Bilirubin 26-51 micromol/l or AST 60-180 u/l 50% dose reduction</td>
</tr>
<tr>
<td>CrCl 15-50ml/min 25% dose reduction</td>
<td>Bilirubin &gt; 51 micromol/l or AST &gt; 180 u/l – clinical decision</td>
</tr>
<tr>
<td>CrCl &lt;15 ml/min 50% dose reduction</td>
<td></td>
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<tr>
<td>Subsequent doses should be based on clinical response</td>
<td></td>
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</tbody>
</table>

Cyclophosphamide - discuss with consultant

<table>
<thead>
<tr>
<th>Renal impairment</th>
<th>Hepatic impairment</th>
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</thead>
<tbody>
<tr>
<td>GFR (mL/min)</td>
<td>Dose</td>
</tr>
<tr>
<td>&gt;20</td>
<td>100%</td>
</tr>
<tr>
<td>10-20</td>
<td>75%</td>
</tr>
<tr>
<td>&lt;10</td>
<td>50%</td>
</tr>
<tr>
<td>Clinical decision – consider whether patient is being treated with high dose treatment</td>
<td>Clinical decision. Exposure to active metabolites may not be increased, suggesting dose reduction may not be necessary</td>
</tr>
</tbody>
</table>

INVESTIGATIONS

- FBC, Coagulation screen.
- U&E, LFT.
- Calculated creatinine clearance.
- Recent bone marrow aspirate/trephine.
- CT scan if appropriate.
- Neurological assessment with nelarabine therapy
CONCURRENT MEDICATION

<table>
<thead>
<tr>
<th>Tumour Lysis Prophylaxis</th>
<th>Allopurinol 300mg PO once daily (cycle 1 only). Start 24 hours prior to chemotherapy and continue for 14 days OR Rasburicase if WCC &gt; 100 x 10⁹/L or patient has bulky disease e.g. Large mediastinal mass or elevated urate at diagnosis. As per local policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aciclovir</td>
<td>200mg PO three times a day</td>
</tr>
<tr>
<td>PPI</td>
<td>Daily if clinically indicated</td>
</tr>
<tr>
<td>Antifungal Prophylaxis</td>
<td>Refer to local antifungal policy.</td>
</tr>
<tr>
<td>Co-trimoxazole</td>
<td>480mg OD on Monday, Wednesday and Friday if neutrophils &gt; 1 x 10⁹/L and platelets &gt; 100 x 10⁹/L.</td>
</tr>
<tr>
<td>Mesna (only in patients pre-existing bladder disorders and at risk of haemorrhagic cystitis)</td>
<td>The oral dose of mesna is 40% of the dose of the cyclophosphamide given on 3 occasions at intervals of 4 hours beginning 2 hours before the cyclophosphamide injection; thus a total dose of mesna equivalent to 120% of the cyclophosphamide is given. In patients at high-risk of urothelial toxicity a shorter interval may be left between oral mesna doses, or the number of doses increased, or both. Alternatively, the initial dose of mesna (20% of the dose of the Cyclophosphamide) may be given intravenously at the same time as cyclophosphamide, followed by two oral doses (each 40% of the dose of the Cyclophosphamide) given 2 and 6 hours after the intravenous dose</td>
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ANTI-EMETICS

Days 1-5: Moderate-High
Days 7-11: Low risk

ADVERSE EFFECTS / REGIMEN SPECIFIC COMPLICATIONS

Neurotoxicity
Severe neurological reactions have been reported with the use of nelarabine. These reactions have included altered mental states including severe somnolence, central nervous system effects including convulsions, and peripheral neuropathy ranging from numbness and paresthesias to motor weakness and paralysis. There have also been reports of reactions associated with demyelination, and ascending peripheral neuropathies similar in appearance to Guillain-Barré Syndrome.

Patients treated previously or concurrently with intrathecal chemotherapy or previously with craniospinal irradiations are potentially at increased risk for neurological adverse events and therefore concomitant intrathecal therapy and/or craniospinal irradiation is not recommended. Full recovery from these reactions has not always occurred with cessation of nelarabine.
Therefore, close monitoring for neurological reactions is strongly recommended, and nelarabine must be discontinued at the first sign of neurological reactions of NCI CTCAE Grade 2 or greater.

**Commonly reported toxicities:** G2 and 3 sensory and motor neurotoxicity, febrile neutropenia, ataxia, G3/4 leukopenia, thrombocytopenia.
Other toxicities include: musculoskeletal pain, fever, infections, nausea/vomiting, anorexia, fatigue and rashes, hemorrhagic cystitis.

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**TREATMENT RELATED MORTALITY**

5-10%

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**REFERENCES**


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**REVIEW**

<table>
<thead>
<tr>
<th>Name</th>
<th>Revision</th>
<th>Date</th>
<th>Version</th>
<th>Review date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nadjoua Maouche (Lead Pharmacist)</td>
<td>New protocol</td>
<td>January 2018</td>
<td>1.0</td>
<td>January 2020</td>
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<tr>
<td>Jon Barrett Haematology Pharmacist. NSSG Myeloid Group</td>
<td>Annual Protocol meeting</td>
<td>October 2019</td>
<td>1.1</td>
<td>October 2021</td>
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