

Mini-BEAM Modified

INDICATIONS

LYMPHOMA [ICD-10 codes: C81–86]

- Refractory / relapsed Hodgkin or non-Hodgkin lymphoma after peripheral blood stem cell harvest [Licensed indication (BEA), Off-label use (M)* / NHS funded]

*Ensure compliance with treating Trust's governance framework

TREATMENT INTENT

Disease modification or curative (bridge to transplantation)

PRE-ASSESSMENT

- Ensure histology is confirmed prior to administration of chemotherapy and document in notes.
- Record stage of disease – CT scan (neck, chest, abdomen and pelvis) and / or PET-CT scan, presence or absence of B symptoms, clinical extent of disease, bone marrow trephine (not indicated in Hodgkin if PET/CT scan done).
- Blood tests - FBC, U&Es, LDH, ESR, urate, calcium, magnesium, creatinine, LFTs, glucose, HbA1c, Igs, β_2 microglobulin, hepatitis B core antibody and hepatitis B surface antigen, hepatitis C antibody, EBV, CMV, VZV, HIV, HTLV-1, glucose 6-phosphate dehydro-genase (G6PD) when indicated [H.8], group and save.
- Hodgkin lymphoma patients** – send a "group and save" sample to transfusion laboratory and ensure patient has been flagged to blood bank for the requirement of **irradiated blood products** for all future transfusions. Refer to local guidelines, e.g. [OUH Guidelines for the Use of Blood Components].
- Urine pregnancy test - before cycle 1 of each chemotherapy course for women of child-bearing age unless they are post-menopausal, have been sterilised or had a hysterectomy.
- ECG +/- ECHO - if clinically indicated.
- Record performance status [ECOG].
- Record vital signs, height and weight.
- Consent and counseling – ensure patient has received adequate verbal and written information regarding their disease, treatment and potential side effects. Document all information provided in medical notes. Obtain written consent prior to treatment.
- Discuss the pregnancy and breastfeeding risks if relevant. An effective contraception is required for both male and female patients during treatment and up to 6 months after ending treatment.
- Fertility – it is very important the patient understands the potential risk of infertility; all patients should be offered fertility advice by referring to the Oxford Fertility Unit.
- Assess and document tumour lysis risk. Patients should be adequately hydrated before and after each cycle administration. In bulky disease pre-hydrate with sodium chloride 0.9% 1 litre over 4–6 hours. Refer to the Tumour Lysis Syndrome in Adults protocol [H.8].
- Advise dental check is carried out by patient's own dental practitioner before treatment starts.
- Consider inserting a dual lumen tunnelled central venous catheter or PICC line if poor venous access or if used as a bridge to transplantation.
- This regimen can be delivered during an inpatient stay or in ambulatory setting for patient(s) meeting the criteria. Refer to the local Ambulatory Care Operational Policy.**
- Treatment should be agreed in the relevant MDT.

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DRUG REGIMEN

The protocol has been modified from 6 to 5 days by the Protocol Steering Group (March 2001 and November 2001) to allow outpatient administration, ensuring that the overall dosage of Etoposide and Cytarabine remains similar whether given over 5 or 6 days.

Day(s)	Drug	Dose	Route	Administration details
1	CARMUSTINE (BCNU)	60 mg/m²	IV	In 500 mL glucose 5% over 1 hour
2–4	ETOPOSIDE	100 mg/m²	IV	In 500-1000 mL sodium chloride 0.9% over 1 hour [concentration 0.05–4 mg/ml]
2–4	CYTARABINE	150 mg/m² TWICE daily	IV	In 250 mL sodium chloride 0.9% over 30 minutes *For Outpatients: can be administered via an ambulatory infusion pump; if the maximum flow rate of infusion pump is < 500 mL/hour, replace diluent with 100 mL sodium chloride 0.9%
2–4	Sodium chloride 0.9% (Polyfusor)	12 mL	IV	*For Outpatients: To maintain line patency with the use of a CADD pump and once daily outpatient visits, infuse sodium chloride at a rate of 0.5 mL/hour via a Y-site connector, using a suitable elastomeric device
5	MELPHALAN	30 mg/m²	IV	In 100 mL sodium chloride 0.9% over 30 minutes
CYCLE FREQUENCY: 21–28 days, depending on blood counts recovery				
DURATION: 3 cycles				

CONCURRENT MEDICATIONS

TLS prophylaxis	Hydration + Allopurinol 300 mg OD (reduce dose in renal impairment) for 7 days or consider Rasburicase if high risk TLS [Cycle 1]. Refer for full details to the Tumour Lysis Syndrome in Adults protocol [H.8] .
Antiviral prophylaxis	Aciclovir 200 mg TDS during treatment and for 3 months after completion
PJP prophylaxis	Co-trimoxazole 480 mg OD three times a week on Mon/Wed/Fri for duration of treatment and 3 months after completion. Consider reducing the dose to 480 mg OD twice weekly during neutropenic periods. Pentamidine can be considered for patients who are intolerant or allergic to Co-trimoxazole.
Antifungal prophylaxis	Fluconazole 50 mg OD for the duration of treatment
G-CSF prophylaxis	Filgrastim 0.5 MU/kg/day, starting from day 6 for 7 days
Mouth care	Benzydamine 0.15% mouthwash/spray: 15 mL / 1 spray QDS when required
Anti-emetics Day 1: High-Moderate risk Days 2–5: Moderate risk	- Dexamethasone on day 1: 8 mg OD - Ondansetron on days 1–5: 8 mg BD - Metoclopramide on days 1–8: 10–20 mg TDS. For breakthrough nausea or vomiting: 10–20 mg TDS when required. For alternative options, refer to [TVCA Anti-emetic guideline] .
Gastric protection*	If required, Omeprazole 20 mg OD, OR Famotidine 20 mg BD for the duration of treatment

(*) indicates optional concurrent medications

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CONTRAINDICATIONS

Refer to individual medications Summary of Product Characteristics (SmPCs).
Pregnancy and breast-feeding.

INVESTIGATIONS

Twice weekly FBC, U&Es, LFTs

RESTAGING

Consider response assessment (CTCAP or PET/CT) after 1–2 cycles based on clinical context.

TREATMENT MODIFICATIONS

Any treatment modifications should be discussed with the Consultant.

Haematological toxicities:

If neutrophil count is $< 1.0 \times 10^9/L$ or platelets $< 50 \times 10^9/L$, delay cycle for one week and recheck blood count. Consider dose reductions at the Consultant discretion.

Non-haematological toxicities

	Renal impairment	Hepatic impairment
Carmustine (BCNU)	GFR > 60 mL/min: 100% dose GFR 46–60 mL/min: 80% dose GFR 30–45 mL/min: 75% dose GFR < 30 mL/min: omit	Mild and moderate: no need for dose adjustment is expected – clinical decision Severe: omit
Etoposide	GFR > 50 mL/min: 100% dose GFR 15–50 mL/min: 75% dose, increase if tolerated GFR < 15 mL/min: no data, clinical decision	Bilirubin < 50 μ mol/L, normal albumin and normal renal function: 100% dose Bilirubin ≥ 50 μ mol/L or decreased albumin levels: consider 50% dose; increase if tolerated
Cytarabine	No need for dose adjustment is expected – clinical decision	Mild and moderate: no need for dose adjustment is expected, clinical decision Severe: consider 25–50% of the original dose and increase if tolerated
Melphalan	GFR > 50 mL/min: 100% dose GFR 30–50 mL/min: consider 50% dose GFR < 30 mL/min: omit	No need for dose adjustment is expected – clinical decision.

DRUG INTERACTIONS

Nephrotoxic medications	Consider potential for increased nephrotoxicity when used concurrently with Melphalan and monitor renal function closely.
CYP3A4 inhibitors and inducers	Consider potential for increased toxicity of Etoposide with CYP3A4 inhibitors and its decreased efficacy with CYP3A4 inducers.
Phenytoin	Consider potential for decreased Etoposide efficacy. Phenytoin levels may also be reduced when used concurrently with Carmustine.
Digoxin	Carmustine and Cytarabine may affect plasma digoxin levels

Immunisation with live vaccines is not recommended during Mini-BEAM Modified treatment.

ADVERSE EFFECTS / REGIMEN SPECIFIC COMPLICATIONS

- Myelosuppression, nausea and vomiting
- Carmustine: pulmonary toxicity (although more common with higher doses); hypotension and flushing during the infusion (due to alcohol content of diluent), injection site reaction.
- Cytarabine: "cytarabine syndrome" (immunoallergic effect), characterised by fever, myalgia, bone pain, occasionally chest pain, maculopapular rash, conjunctivitis, nausea and malaise (usually occurs 6–12 hours after administration)
- Melphalan: mucositis, diarrhoea
- Etoposide: hypotension on rapid infusion, hyperbilirubinaemia

EXTRAVASTATION RISK

Carmustine: vesicant
Cytarabine: neutral
Etoposide: irritant
Melphalan: neutral

PREGNANCY AND BREAST-FEEDING

- Pregnancy: There is a risk of fetal harm in pregnant women. Effective contraception methods should be discussed with all patients of reproductive potential (see PRE-ASSESSMENT above).
- Breast-feeding: Possibility of risk to infant should be discussed with breastfeeding patients. Breast-feeding should not be permitted during the treatment and for at least 1 week after the last dose of Cytarabine.

TREATMENT RELATED MORTALITY

2–5%

REFERENCES

1. Girouard C, Dufresne J, Imrie K, Stewart AK, Brandwein J, Prince HM, Pantolony D, Keating A, Crump M. Salvage chemotherapy with mini-BEAM for relapsed or refractory non-Hodgkin's lymphoma prior to autologous bone marrow transplantation. *Ann Oncol.* 1997 Jul;8(7):675-80.
2. Moore S, Kayani I, Peggs K, Qian W, Lowry L, Thomson K, Linch DC, Ardeschna K. Mini-BEAM is effective as a bridge to transplantation in patients with refractory or relapsed Hodgkin lymphoma who have failed to respond to previous lines of salvage chemotherapy but not in patients with salvage-refractory DLBCL. *Br J Haematol.* 2012 Mar 20.

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3. Tillomed Laboratories Ltd. Carmustine 100 mg-Powder and solvent for solution for infusion. Summary of Product Characteristics (SmPC). Last updated 03/11/2021. Available at <https://www.medicines.org.uk/emc/> <Last accessed 14/09/2025>
4. Hikma Farmacêutica, S.A. Etoposide 20 mg/ml Concentrate for Solution for Infusion. Summary of Product Characteristics (SmPC). Available at <https://products.mhra.gov.uk/> <Last accessed 14/09/2025>
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6. Tilomed Laboratories Ltd. Melphalan 50 mg powder and solvent for solution for injection/infusion. Summary of Product Characteristics (SmPC). Last updated 12/03/2024. Available at <https://www.medicines.org.uk/emc/> <Last accessed 14/09/2025>
7. Giraud EL, de Lijster B, Krens SD, Desar IME, Boerrigter E, van Erp NP. Dose recommendations for anticancer drugs in patients with renal or hepatic impairment: an update. *Lancet Oncol* 2023; 24: e229

REVIEW

Name	Revision	Date	Version	Review date
Cheuk-kie Jackie Cheung (Haematology Pharmacist)	Melphalan volume changed	Sep 2018	1.3	
NSSG Lymphoma Group, Cheuk-kie Jackie Cheung (Haematology Pharmacist)	Annual protocol review. Cytarabine volume changed and ambulatory care information added.	May 2019	1.4	May 2021
Natalia Czub, Advanced Haematology Pharmacist, Dr Murali Kesavan, Haematology Consultant, NSSG Lymphoma Group	General formatting, indications, contraindications, interactions, and references sections updated. Annual protocol review.	July 2022	2.0	July 2024
Natalia Czub, Advanced Haematology Pharmacist, Dr Graham Collins, Haematology Consultant, NSSG Lymphoma & CLL Group	Drug regimen, Drug interactions updated. Pregnancy and Breast-feeding section added. General formatting. Annual protocol review.	September 2025	3.0	September 2028