

Fludarabine & cycloPHOSphamide Lymphodepletion for Tisagenlecleucel (Kymriah®) B-cell ALL

INDICATIONS FOR USE:

INDICATION	ICD10	Regimen Code	HSE approved reimbursement status
Lymphodepleting chemotherapy regimen pre-treatment for CAR-T therapy Tisagenlecleucel (Kymriah®) in young adults and adult patients with B-cell ALL that is refractory, in relapse post-transplant or in second or later relapse	C91	00607a	N/A

* This is for post 2012 indications only.

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 patients individual clinical circumstances.

Tisagenlecleucel (Kymriah®) must be administered in an NCCP designated CAR-T centre.

Facilities to treat anaphylaxis MUST be present when the chemotherapy and CAR-T cells are administered.

Pre-treatment conditioning:

- Lymphodepleting chemotherapy is recommended to be administered before tisagenlecleucel infusion unless the white blood cell (WBC) count within one week prior to infusion is $\leq 1 \times 10^9/L$
- Lymphodepleting chemotherapy may be omitted if a patient's white blood cell (WBC) count is $\leq 1 \times 10^9/L$ cells within 1 week prior to tisagenlecleucel infusion.

Tisagenlecleucel Administration:

- Please refer to the local CAR-T policy for tisagenlecleucel (Kymriah®) information
- Tisagenlecleucel is recommended to be infused 2 to 14 days after completion of the lymphodepleting chemotherapy

NCCP Regimen: Fludarabine and cycloPHOSphamide Lymphodepletion for Tisagenlecleucel B-cell ALL	Published: 02/11/2021 Review: 04/03/2029	Version number: 3
Tumour Group: Leukaemia NCCP Regimen Code: 00607	IHS Contributor: Dr Larry Bacon	Page 1 of 6

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>

This information is valid only on the day of printing, for any updates please check www.hse.ie/NCCPchemoregimens

Day	Drug	Dose	Route	Diluent & Rate	Cycle
-6, -5, -4, -3	Fludarabine ¹	30mg/m ²	IV	100mL sodium chloride 0.9% over 30 minutes	1
-6,-5	Mesna	200mg/m ²	IV	Slow IV bolus Into the side arm of a fast flowing sodium chloride 0.9% infusion	1
-6, -5,	cycloPHOSphamide	500mg/m ²	IV	500mL sodium chloride 0.9% over 60 minutes	1
-6,-5	Mesna	200mg/m ²	IV	At 2 and 6 hours after the start of cycloPHOSphamide infusion (4 doses in total)	1
0	Tisagenlecleucel (Kymriah®)		IV	Please refer to the hospital's CAR-T policy for Tisagenlecleucel (Kymriah®)	

¹All patients who have received fludarabine should receive irradiated blood products (lifetime recommendation)

Dose rounding:
 Fludarabine doses ≤50mg to the nearest 2.5mg and doses ≥50mg to the nearest 5mg
 cycloPHOSphamide to the nearest 20mg
 Mesna to the nearest 100mg for IV route

Notes:

- The availability of tisagenlecleucel must be confirmed prior to starting the lymphodepleting regimen. If there is a delay of more than 4 weeks between completing lymphodepleting chemotherapy and the infusion and the WBC count is >1 x10⁹/L, then the patient should be re-treated with lymphodepleting chemotherapy prior to receiving tisagenlecleucel.

ELIGIBILITY:

- Indications as above
- Medical assessment as per local CAR-T assessment form

EXCLUSIONS:

- Known or suspected hypersensitivity to fludarabine, cycloPHOSphamide or tisagenlecleucel or any of the excipients.
- Active, severe infections (e.g. tuberculosis, sepsis and opportunistic infections)
- Pregnancy and lactation
- Haemolytic anaemia

PRESCRIPTIVE AUTHORITY:

- Haematology Consultant working in the area of haematological malignancies who is trained in the administration and management of patients treated with tisagenlecleucel within a designated CAR-T treatment centre.

NCCP Regimen: Fludarabine and cycloPHOSphamide Lymphodepletion for Tisagenlecleucel B-cell ALL	Published: 02/11/2021 Review: 04/03/2029	Version number: 3
Tumour Group: Leukaemia NCCP Regimen Code: 00607	IHS Contributor: Dr Larry Bacon	Page 2 of 6
<p>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</p> <p><i>This information is valid only on the day of printing, for any updates please check www.hse.ie/NCCPchemoregimens</i></p>		

TESTS:

- Baseline and regular tests carried out in accordance with local CAR-T Work-up Protocol.

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.

No steroids should be administered without approval of the treating Haematology Consultant.

DOSE MODIFICATIONS:

- Any dose modifications of should be discussed with the treating Haematology Consultant.
- **Chemotherapy dosing in obese adult patients:** See local policy

Renal and Hepatic Impairment:

Discuss with the treating consultant if hepatic impairment or if creatinine clearance is < 70ml/min for advice on fludarabine dosing.

Consult the following resources to inform any renal or hepatic dose modification discussions:

- Summary of product characteristics (SPC) available at <http://www.hpra.ie>
- 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.
- Local hospital policy

MANAGEMENT OF ADVERSE EVENTS:

- Refer to local policy

SUPPORTIVE CARE

EMETOGENIC POTENTIAL: Moderate (**Refer to local policy**).

Table 1: Suggested Regimen Specific Anti-emetics^a

Prevention of acute emesis			Prevention of delayed emesis			Comments
Drug	Dose	Admin day	Drug	Dose	Admin day	
Ondansetron	8mg PO/IV TDS	-6 to -3	Ondansetron	8mg PO/IV TDS	-2	dexAMETHasone not used as part of anti-emetic regimen prior to tisagenlecleucel infusion
Cyclizine	50mg PO TDS	-6 to -3	Cyclizine	50mg PO TDS	-2 to -1 then switch to PRN	

^aBased on local practice in St James Hospital when V1 of regimen developed

NCCP Regimen: Fludarabine and cycloPHOSphamide Lymphodepletion for Tisagenlecleucel B-cell ALL	Published: 02/11/2021 Review: 04/03/2029	Version number: 3
Tumour Group: Leukaemia NCCP Regimen Code: 00607	IHS Contributor: Dr Larry Bacon	Page 3 of 6
<p>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</p> <p><i>This information is valid only on the day of printing, for any updates please check www.hse.ie/NCCPchemoregimens</i></p>		

OTHER SUPPORTIVE CARE:

Table 2: Other Suggested Supportive Medication^a

HSV prophylaxis	<p>All patients should receive the following until CD4 count >200/microlitre:</p> <ul style="list-style-type: none"> Valaciclovir 500mg once daily PO <p>or</p> <ul style="list-style-type: none"> Aciclovir 250mg TDS IV (if oral route not available or ANC < 0.5X10⁹/L) <p>Patients with an active herpes infection should receive the following:</p> <ul style="list-style-type: none"> Valaciclovir 1g TDS PO <p>or</p> <ul style="list-style-type: none"> Aciclovir 10mg/kg TDS IV (if oral route not available)
Antifungal prophylaxis	<p>Anti-fungal prophylaxis is commenced on the first day of lymphodepleting chemotherapy (D-6) and continued until neutrophil count $\geq 1 \times 10^9$/L and complete remission.</p> <p>Posaconazole PO 300mg twice daily on D-6, then 300mg once daily thereafter.</p>
PJP prophylaxis	<p><u>All patients should receive the following for three months post-CAR-T infusion or until CD4 count >200/microlitre:</u></p> <p><u>PJP prophylaxis is started on the first day of lymphodepleting chemotherapy (D-6)</u></p> <p><u>1st line therapy</u></p> <ul style="list-style-type: none"> Co-trimoxazole 960mg BD Mon/Wed/Fri PO <p><u>2nd line therapy (if allergic to co-trimoxazole or contraindicated):</u></p> <ul style="list-style-type: none"> Pentamidine 300mg nebule and salbutamol 2.5mg nebule pre-pentamidine, every 4 weeks
Mouthcare	<p>Mucositis WHO grade < 2:</p> <ul style="list-style-type: none"> Sodium chloride 0.9% 10ml QDS mouthwash Nystatin 1ml QDS PO (use 15 minutes after sodium chloride 0.9% mouthwash) <p>Mucositis WHO grade ≥ 2:</p> <ul style="list-style-type: none"> Chlorhexidine digluconate 0.12% (Kin[®]) 10mls QDS PO Nystatin 1ml QDS PO (use 15 minutes after Kin[®] mouthwash)
Gastro protection	<ul style="list-style-type: none"> Lansoprazole 30mg / omeprazole 40mg once daily PO <p>or</p> <ul style="list-style-type: none"> Esomeprazole 40mg once daily IV (if oral route not available)
Prevention of vaginal bleeding	<p>If required for menstruating female patients until platelets > 50 x10⁹/L</p> <ul style="list-style-type: none"> Norethisterone 5mg TDS PO if >55Kg Norethisterone 5mg BD PO if <55kg

NCCP Regimen: Fludarabine and cycloPHOSphamide Lymphodepletion for Tisagenlecleucel B-cell ALL	Published: 02/11/2021 Review: 04/03/2029	Version number: 3
Tumour Group: Leukaemia NCCP Regimen Code: 00607	IHS Contributor: Dr Larry Bacon	Page 4 of 6
<p>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</p> <p><i>This information is valid only on the day of printing, for any updates please check www.hse.ie/NCCPchemoregimens</i></p>		

Tumour Lysis syndrome	<p>Consider allopurinol in active disease pre transplant</p> <ul style="list-style-type: none"> Allopurinol 300mg once daily PO for 5-7 days and review
Hepatitis B prophylaxis/treatment	<p>A virology screen is completed as part of transplant workup. Hepatitis B prophylaxis or treatment may be initiated in consultation with a Virology Consultant or Hepatology Consultant if required.</p> <p>Options may include:</p> <ul style="list-style-type: none"> Lamivudine 100mg once daily PO Or Entecavir 750microgram once daily PO
Prevention of constipation	<p>Consider laxatives if appropriate e.g.</p> <ul style="list-style-type: none"> Senna two tablets (15mg) nocte PO while on ondansetron
Antibiotic standing order	<p>Antibiotic standing order should be prescribed for neutropenic sepsis/neutropenic fever based on previous microbiology and renal function</p> <ul style="list-style-type: none"> Piptazobactam 4.5g QDS IV plus Amikacin* 15mg/kg once daily IV <p>*Ciprofloxacin 400mg BD IV may be considered instead of amikacin in cases of renal impairment</p> <p>Refer to Antimicrobial Guidelines in the SJH Medicines Guide for antibiotic choice where a patient is allergic to any of the above</p>
Magnesium and potassium standing order	<p>Magnesium and potassium standing orders should be prescribed for all transplant patients in accordance with stem cell unit practice as indicated on EPMAR</p>
VTE prophylaxis	<p>Consider VTE prophylaxis in accordance with SJH policy</p>
Bone Health	<p>Consider calcium and vitamin D supplementation prior to discharge for patients who are on high dose steroids. Other medications for maintenance of bone health may need to be considered as appropriate.</p> <ul style="list-style-type: none"> Calcium carbonate and colecalciferol (Caltrate® 600mg/400units) one tablet BD

^aBased on local practice in St James Hospital when V1 of regimen developed

ADVERSE EFFECTS / REGIMEN SPECIFIC COMPLICATIONS:

- Please refer to the relevant Summary of Product Characteristics and local Stem Cell Transplant Programme PPGs for full details.

NCCP Regimen: Fludarabine and cycloPHOSphamide Lymphodepletion for Tisagenlecleucel B-cell ALL	Published: 02/11/2021 Review: 04/03/2029	Version number: 3
Tumour Group: Leukaemia NCCP Regimen Code: 00607	IHS Contributor: Dr Larry Bacon	Page 5 of 6

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>

This information is valid only on the day of printing, for any updates please check www.hse.ie/NCCPchemoregimens

DRUG INTERACTIONS:

- The relevant Summary of Product Characteristics and current drug interaction databases should be consulted.

COMPANY SUPPORT RESOURCES/Useful Links:

Please note that this is for information only and does not constitute endorsement by the NCCP

HCP Information: <https://www.hcp.novartis.com/products/kymriah/>

REFERENCES:

- Schuster SJ, Svoboda J et al. Chimeric Antigen Receptor T cells in Refractory B-cell Lymphomas. *N Engl J Med* 2017;377:2545-54. DOI: 10.1056/NEJMoa1708566
- Schuster SJ, Bishop MR et al. Tisagenlecleucel in Adult Relapsed or Refractory Diffuse Large B-cell Lymphoma. *N Engl J Med* 2019; 380:45-56 DOI: 10.1056/NEJMoa1804980
- Lymphodepletion protocol for young adults age 18-25 B-cell ALL v1.0. King's College Hospital London.
- Kymriah® Summary of Product Characteristics. Accessed Nov 2023. Available at https://www.ema.europa.eu/en/documents/product-information/kymriah-epar-product-information_en.pdf
- 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.
- NCCP Classification Document for Systemic Anti-Cancer Therapy (SACT) Induced Nausea and Vomiting. V5 2023. Available at: <https://www.hse.ie/eng/services/list/5/cancer/profinfo/chemoprotocols/nccp-classification-document-for-systemic-anti-cancer-therapy-sact-induced-nausea-and-vomiting.pdf>
- NCCP BACKGROUND DOCUMENT EXTRAVASATION CLASSIFICATION OF SYSTEMIC ANTI-CANCER THERAPY V2 2019. Available at: <https://www.hse.ie/eng/services/list/5/cancer/profinfo/medonc/sactguidance/classification.pdf>

Version	Date	Amendment	Approved By
1	02/11/2021		Dr Larry Bacon
2	03/05/2022	Amended indication (patient age) and amended SJH regimen specific anti-emetics (replaced domperidone with cyclizine).	Dr Larry Bacon
3	04/03/2024	Reviewed	Dr Larry Bacon

Comments and feedback welcome at oncologydrugs@cancercontrol.ie

NCCP Regimen: Fludarabine and cycloPHOSphamide Lymphodepletion for Tisagenlecleucel B-cell ALL	Published: 02/11/2021 Review: 04/03/2029	Version number: 3
Tumour Group: Leukaemia NCCP Regimen Code: 00607	IHS Contributor: Dr Larry Bacon	Page 6 of 6
<p>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</p> <p><i>This information is valid only on the day of printing, for any updates please check www.hse.ie/NCCPchemoregimens</i></p>		