LACE-Conditioned Autologous Stem Cell Transplantation in Lymphoma: A Safe and Effective Regimen

A 19-year single-centre experience in 281 patients

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Introduction

High-dose chemotherapy followed by autologous stem cell transplantation (HDT-ASCT) remains an established treatment strategy in lymphoma, both as salvage consolidation in relapsed/refractory disease and as frontline consolidation in selected lymphoma subtypes.

BEAM is the most widely used conditioning regimen; however, treatment-related toxicity may limit its suitability in some patients.

LACE (lomustine, cytarabine, cyclophosphamide and etoposide) is an alternative conditioning regimen with demonstrated efficacy and a favourable toxicity profile.

This study reports extended follow-up across lymphoma subtypes to evaluate the long-term safety and efficacy of LACE-conditioned HDT-ASCT, representing the most mature and comprehensive analysis of this conditioning approach to date.

Aim

To evaluate the long-term efficacy and safety of LACE-conditioned HDT-ASCT across lymphoma subtypes in relapsed/refractory and frontline consolidation settings.

Methods

- **Study Design:** Single-centre retrospective cohort study (2006–2024).
- **Staging & Response:** Ann Arbor staging and International Workshop and/or Lugano response criteria.
- **Efficacy Endpoints:** Overall survival (OS) and Progression-Free Survival (PFS).
- **Safety Endpoints:** Day +100 non-relapse mortality (NRM), engraftment, ICU admission and grade ≥3 adverse events.
- **Statistical Analysis:** Kaplan-Meier analysis for survival; Multivariable Cox regression to identify prognostic factors for OS.
- **Data Follow up cut off:** 31 May 2026.

Results

N = 281
Overall cohort undergone LACE-conditioned HDT-ASCT.
2006–2024

Median Follow Up
72 Months
(IQR 31–127)

Median Age 49
67% Male
92.9% in CR/PR*

Prior Lines of Treatment
1 line of Treatment
N = 146 (52.0%)
≥ 3 lines of Treatment
N = 16 (5.7%)

*CR: Complete Remission; PR: Partial Remission

LYMPHOMA SUBTYPES

DLBCL (includes transformed lymphoma)	n = 100 (35.6%)
cHL	n = 94 (33.5%)
MCL	n = 41 (14.6%)
PTCL	n = 20 (7.1%)
Other Lymphoma Subtypes*	n = 26 (9.2%)

**Follicular Lymphoma, Marginal Zone Lymphoma, Burkitt Lymphoma, Lymphoblastic Lymphoma, Nodular Lymphocyte-predominant Hodgkin Lymphoma, Plasmablastic Lymphoma, Post-transplant Lymphoproliferative disorder, Primary Effusion Lymphoma, Extranodal NK/T-cell Lymphoma, and Enteropathy-associated T-cell Lymphoma.*

TREATMENT SETTINGS

First line Consolidation Therapy

OR

Salvage Consolidation Therapy in Relapsed/Refractory Disease

DURABLE DISEASE OUTCOMES – 5-YEAR OVERALL SURVIVAL (OS) AND PROGRESSION-FREE SURVIVAL (PFS)

DLBCL (includes transformed lymphoma) n = 100		cHL n = 94		MCL n = 41		PTCL n = 20	
OS	PFS	OS	PFS	OS	PFS	OS	PFS
57.6% (48.0–69.2%)	**58.1%** (48.1–70.2%)	**78.6%** (69.9–88.3%)	**73.2%** (64.0–83.6%)	**66.2%** (50.1–87.4%)	**65.1%** (48.2–88.1%)	**72.3%** (54.2–96.4%)	**52.3%** (33.7–81.2%)

PROGNOSTIC EVALUABLE DATA

Multivariable Cox Analysis
N = 172

Independent Adverse Prognostic Factors

- **Age > 60 years** (HR 8.9, 95% CI 2.6–30.9; p < 0.001)
- **Extranodal disease** (HR 2.1, 95% CI 1.0–4.4; p = 0.047)

SAFETY EVALUABLE DATA

N = 169

FAVOURABLE TOXICITY PROFILE

Grade ≥3 Mucositis	ICU admission	Day +100 NRM
14.2%	**4.1%**	**3.0%**

Prompt engraftment
Neutrophils: **12** days • Platelets: **14** days

Safety data only available in 169 patients due to lack of safety data in patients pre-introduction of uniform electronic medical record.

Conclusion

- **LACE-conditioned HDT-ASCT demonstrated:**

Durable efficacy
Sustained long-term disease control across major lymphoma subtypes, with a median follow-up of 72 months.

Favourable tolerability
Low rates of grade ≥3 mucositis (14.2%), day +100 NRM (3.0%) and ICU admission (4.1%).

Prompt engraftment
Median neutrophil and platelet engraftment at 12 and 14 days, respectively.

- In the era of CAR T-cell therapies and bispecific antibodies, ASCT retains an important role in lymphoma management. These long-term findings support LACE as an effective and well-tolerated conditioning regimen in appropriately selected patients.
- Older age and extranodal involvement were independent adverse prognostic factors for OS.
- Limitations: Retrospective single-centre design, absence of direct comparison with alternative conditioning regimens and restriction of multivariable analysis to a subset of patients, with potential for selection bias.

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