

Supplementary Online Content

Wu H, Shi J, Luo Y, et al. Assessment of patient-specific human leukocyte antigen genomic loss at relapse after antithymocyte globulin–based T-cell–replete haploidentical hematopoietic stem cell transplant. *JAMA Netw Open*. 2022;5(4):e226114. doi:10.1001/jamanetworkopen.2022.6114

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Covariates Included in the Final Logistic Regression Models for Diagnosing HLA Loss at Relapse

Variations			
	Myeloid malignancies group, No. (%) , n=53 (50)		
	Loss n=29 (54.7)	Classical n=24 (45.3)	<i>P</i> value
Sex of patient			0.11
Male	16/24 (66.7)	8/24 (33.3)	
Female	13/29 (44.8)	16/29 (55.2)	
WBC at diagnosis (× 10 ⁹ /L)			>0.99
< 50	5/9 (55.6)	4/9 (44.4)	
≤ 50	24/44 (54.5)	20/44 (55.6)	
Disease status at HSCT			0.55
CR	17/33 (51.5)	16/33 (48.5)	
AD	12/20 (60.0)	8/20 (40.0)	
R-DRI			0.007
Low	1/1 (100.0)	0/1 (0.0)	
Intermediate	12/28 (42.9)	16/28 (57.1)	
High	16/21 (76.2)	5/21 (23.8)	
Very high	0/3 (0.0)	3/3 (100.0)	
Pre-transplant BMI			0.01
Underweight	2/10 (20.0)	8/10 (80.0)	
No underweight	27/41 (65.9)	14/41 (34.1)	
De novo acute GVHD			0.03
No	13/31 (41.9)	18/31 (58.1)	
Yes	16/22 (72.7)	6/22 (27.3)	
Chronic GVHD			0.02
No	14/33 (42.4)	19/33 (57.6)	
Yes	15/20 (75.0)	5/20 (25.0)	
> 180 days from HSCT to relapse			0.03
No	5/22 (22.7)	17/22 (77.3)	
Yes	20/31 (64.5)	11/31 (35.5)	
	Lymphoid malignancies group, No. (%), n=53 (50)		
	Loss n=25 (47.2)	Classical n=28 (52.8)	<i>P</i> value
Sex of patient			0.02
Male	9/28 (32.1)	19/28 (67.9)	
Female	16/25 (64.0)	9/25 (36.0)	
WBC at diagnosis (× 10 ⁹ /L)			0.78
< 50	8/18 (44.4)	10/18 (55.6)	
≤ 50	17/35 (48.6)	18/35 (51.4)	

BM blasts ratio at diagnosis above median (86%)			0.07
No	17/29 (58.6)	12/29 (41.4)	
Yes	8/24 (33.3)	16/24 (66.7)	
Disease status at HSCT			0.43
AD	2/7 (28.6)	5/7 (71.4)	
CR	23/46 (50.0)	23/46 (50.0)	
Donor to recipients			0.01
Female to female	7/7 (100.0)	0/7 (0.0)	
Female to male	2/8 (25.0)	6/8 (75.0)	
Male to male	7/20 (35.0)	13/20 (65.0)	
Male to female	9/18 (50.0)	9/18 (50.0)	
Pre-transplant BMI			0.07
Underweight	9/13 (69.2)	4/13 (30.8)	
No underweight	16/40 (40.0)	24/40 (60.0)	
MNC cells above median ($12.4 \times 10^8/\text{kg}$)			0.13
No	10/27 (37.0)	17/27 (63.0)	
Yes	15/26 (57.7)	11/26 (42.3)	
Chronic GVHD			0.009
No	17/44 (38.6)	27/44 (61.4)	
Yes	8/9 (88.9)	1/9 (11.1)	
MRD-positivity before relapse			0.16
No	18/43 (41.9)	25/43 (58.1)	
Yes	7/10 (70.0)	3/10 (30.0)	
> 180 days from HSCT to relapse			0.003
No	5/22 (22.7)	17/22 (77.3)	
Yes	20/31 (64.5)	11/31 (35.5)	

Abbreviations: CI, confidence interval; HR, hazard ratio; prOS, postrelapse overall survival.

eTable 2. Univariate and Multivariate Analyses of prOS in Patients With Myeloid Cancer

A. Univariate analysis

	Myeloid malignancies					
Variations	Loss Group			Classical Group		
	HR	95%CI	<i>P</i> value	HR	95%CI	<i>P</i> value
Sex of patient						
Female	Ref.		0.25	Ref.		0.86
Male	0.611	0.262-1.426		1.102	0.366-3.315	
Age above median (44.5 years)						
No	Ref.		0.18	Ref.		0.03
Yes	0.544	0.223-1.326		0.235	0.062-0.893	
WBC at diagnosis (× 10 ⁹ /L)						
≤ 50	Ref.		0.05	Ref.		0.48
> 50	3.184	1.024-9.902		1.643	0.420-6.431	
FLT3-ITD variant						
No	Ref.		0.25	Ref.		0.13
Yes	1.816	0.655-5.039		0.191	0.023-1.592	
EMD before HSCT						
No	-	-	-	Ref.		0.99
Yes	-	-	-	0.989	0.124-7.867	
Disease status at HSCT						
AD	Ref.		0.82	Ref.		0.96
CR	1.106	0.461-2.651		1.045	0.226-4.831	

MRD negative CR before HSCT						
No	Ref.		0.21	Ref.		0.81
Yes	1.748	0.737-4.149		1.159	0.355-3.785	
R-DRI						
Low	Ref.		0.95	-	-	-
Intermediate	1.352	0.170-10.765		Ref.		0.02
High	1.405	0.178-11.085		14.802	2.172-100.895	
Very high	-	-		2.744	0.304-24.753	
Sex of donor						
Female	Ref.		0.75	Ref.		0.85
Male	1.166	0.455-2.985		0.900	0.298-2.717	
Donor to recipients						
Female to female	Ref.		0.11	Ref.		0.99
Female to male	2.183	0.411-11.601		1.320	0.207-8.402	
Male to male	1.088	0.293-4.036		1.011	0.216-4.737	
Male to female	4.057	0.940-17.518		0.991	0.231-4.247	
Pre-transplant BMI						
Underweight	Ref.		0.78	Ref.		0.23
No underweight	0.811	0.183-3.588		0.437	0.114-1.672	
Conditioning regimen						
MAC	Ref.		0.10	Ref.		0.57
RIC	0.181	0.024-1.357		1.853	0.226-15.226	
ATG type						
ATG-G	Ref.		0.41	Ref.		0.82
ATG-F	0.682	0.275-1.691		1.133	0.385-3.334	

De novo acute GVHD						
No	Ref.		0.79	Ref.		0.82
Yes	1.124	0.479-2.639		1.170	0.311-4.410	
Chronic GVHD						
No	Ref.		0.84	Ref.		0.04
Yes	0.916	0.393-2.135		4.710	1.118-19.846	
DLI before relapse						
No	Ref.		0.80	Ref.		0.93
Yes	0.897	0.380-2.116		0.951	0.304-2.975	
HSCT to relapse > 180 days						
No	Ref.		0.71	Ref.		0.49
Yes	1.208	0.442-3.304		0.690	0.240-1.987	
BM blast > 20% at relapse						
No	Ref.		0.16	Ref.		0.61
Yes	1.884	0.787-4.510		1.486	0.319-6.929	
EMD at relapse						
No	Ref.		0.21	Ref.		0.64
Yes	0.391	0.091-1.704		0.604	0.075-4.848	
Response to salvage therapies						
No	Ref.		0.14	Ref.		0.21
Yes	0.464	0.169-1.276		0.372	0.078-1.759	

Abbreviations: CI, confidence interval; HR, hazard ratio; prOS, postrelapse overall survival.

B. Multivariate analysis

Myeloid malignancies			
Variations	HR	95%CI	P value
Loss Group			
Sex of patient			
Female	Ref.		
Male	0.117	0.029-0.470	0.003
WBC at diagnosis ($\times 10^9/L$)			
≤ 50	Ref.		
> 50	7.501	1.328-42.386	0.02
Conditioning regimen			
MAC	Ref.		
RIC	0.032	0.002-0.533	0.02
Response to salvage therapies			
No	Ref.		
Yes	0.091	0.016-0.509	0.006
Classical Group			
Age above median (44.5 years)			
No	Ref.		0.02
Yes	0.141	0.029-0.688	
R-DRI			
Low	-	-	-
Intermediate	Ref.		0.04
High	40.380	3.668-444.59	0.003

Very high	1.298	0.140-12.056	0.82
Chronic GVHD			
No	Ref.		0.46
Yes	3.338	0.141-79.297	

Abbreviations: CI, confidence interval; HR, hazard ratio; prOS, postrelapse overall survival.

eTable 3. Univariate and Multivariate Analyses of prOS in Patients With Lymphoid Cancer

A. Univariate analysis

	Lymphoid malignancies					
Variations	Loss Group			Classical Group		
	HR	95%CI	<i>P</i> value	HR	95%CI	<i>P</i> value
Sex of patient						
Female	Ref.		0.04	Ref.		0.41
Male	2.575	1.030-6.437		0.692	0.290-1.648	
Age above median (27.0 years)						
No	Ref.		0.90	Ref.		0.64
Yes	1.057	0.444-2.515		1.221	0.534-2.789	
WBC at diagnosis (× 10 ⁹ /L)						
≤ 50	Ref.		0.95	Ref.		0.53
> 50	1.027	0.421-2.504		0.749	0.303-1.847	
CAR T-cell therapy before HSCT						
No	Ref.		0.09	Ref.		0.18
Yes	2.783	0.850-9.113		2.101	0.704-6.267	
EMD before HSCT						
No	Ref.		0.87	Ref.		0.29
Yes	0.925	0.357-2.396		0.506	0.142-1.807	
Disease status before HSCT						
AD	Ref.		0.34	Ref.		0.48
CR	0.477	0.105-2.161		1.488	0.500-4.429	

MRD negative CR before HSCT						
No	Ref.		0.93	Ref.		0.76
Yes	0.958	0.370-2.481		1.135	0.496-2.602	
R-DRI						
Low	-	-	-	-	-	-
Intermediate	Ref.		0.54	Ref.		0.21
High	1.342	0.480-3.752		2.565	0.802-8.206	
Very high	2.232	0.483-10.309		0.790	0.256-2.438	
Sex of donor						
Female	Ref.		0.98	Ref.		0.87
Male	1.012	0.389-2.630		0.924	0.355-2.404	
Donor to recipients						
Female to female	Ref.		0.04	-	-	-
Female to male	12.960	1.908-88.029		Ref.		0.62
Male to male	2.251	0.642-7.887		0.737	0.249-2.184	
Male to female	1.070	0.319-3.593		1.200	0.411-3.503	
Pre-transplant BMI						
Underweight	Ref.		0.17	Ref.		0.54
No underweight	0.532	0.217-1.305		1.411	0.474-4.202	
Conditioning regimen						
MAC	-	-	-	Ref.		0.50
RIC	-	-	-	1.524	0.444-5.223	
ATG type						
ATG-G	Ref.		0.16	Ref.		0.26
ATG-F	0.518	0.207-1.296		0.616	0.265-1.431	

De novo acute GVHD						
No	Ref.		0.24	Ref.		0.10
Yes	0.587	0.242-1.422		0.497	0.215-1.149	
Chronic GVHD						
No	Ref.		0.004	Ref.		0.45
Yes	5.235	1.684-16.268		0.044	0.000-132.975	
DLI before relapse						
No	Ref.		0.12	Ref.		0.02
Yes	2.302	0.798-6.642		5.090	1.286-20.148	
HSCT to relapse > 180 days						
No	Ref.		0.55	Ref.		0.004
Yes	1.360	0.492-3.754		0.243	0.093-0.637	
EMD at relapse						
No	Ref.		0.75	1		0.20
Yes	1.149	0.484-2.725		0.452	0.133-1.534	
BM blast > 20% at relapse						
No	Ref.		0.68	Ref.		0.98
Yes	1.206	0.496-2.935		0.987	0.428-2.278	
Response to salvage therapies						
No	Ref.		0.11	Ref.		0.02
Yes	0.362	0.103-1.272		0.164	0.037-0.732	

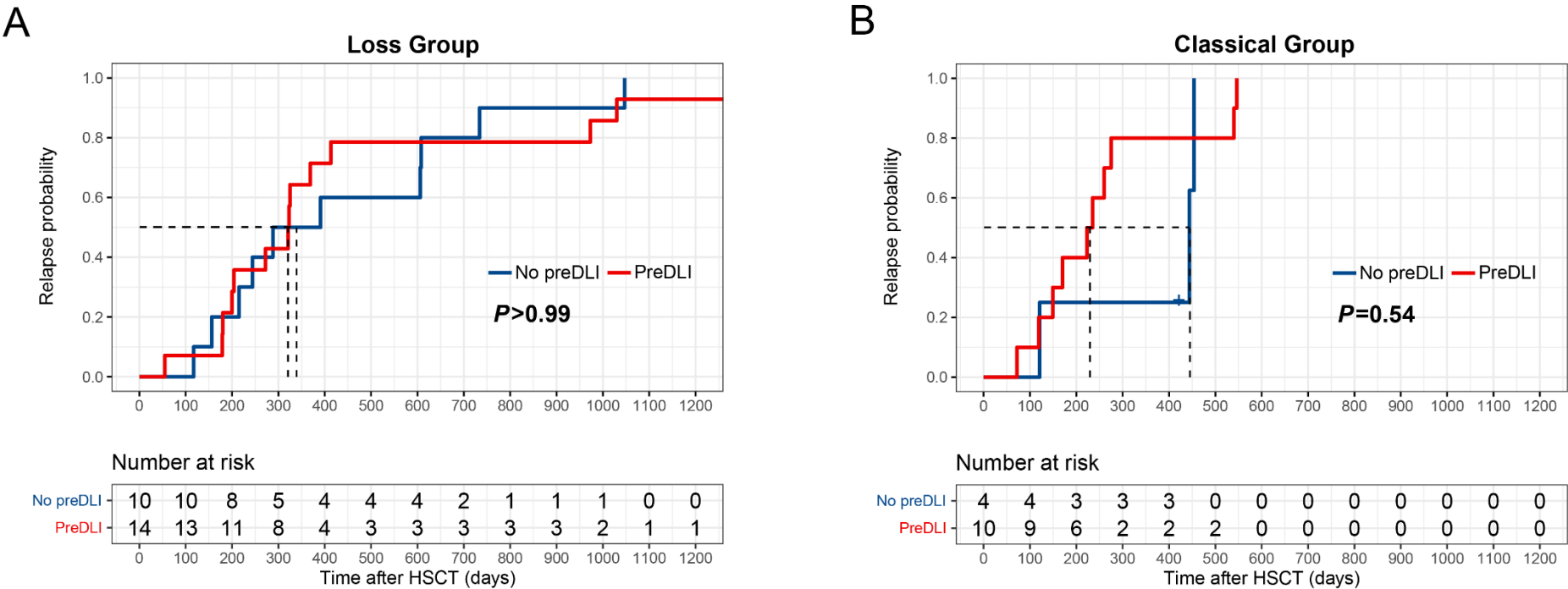
Abbreviations: CI, confidence interval; HR, hazard ratio; prOS, postrelapse overall survival.

B. Multivariate analysis

Lymphoid malignancies			
Variations	HR	95%CI	<i>P</i> value
Loss Group			
Sex of patient			
Female	Ref.		0.03
Male	2.964	1.132-7.758	
Chronic GVHD			
No	Ref.		0.003
Yes	6.271	1.856-21.191	
Classical Group			
Response to salvage therapies			
No	Ref.		0.02
Yes	0.164	0.037-0.732	

eFigure 1. High-Risk Patients With MRD Positivity

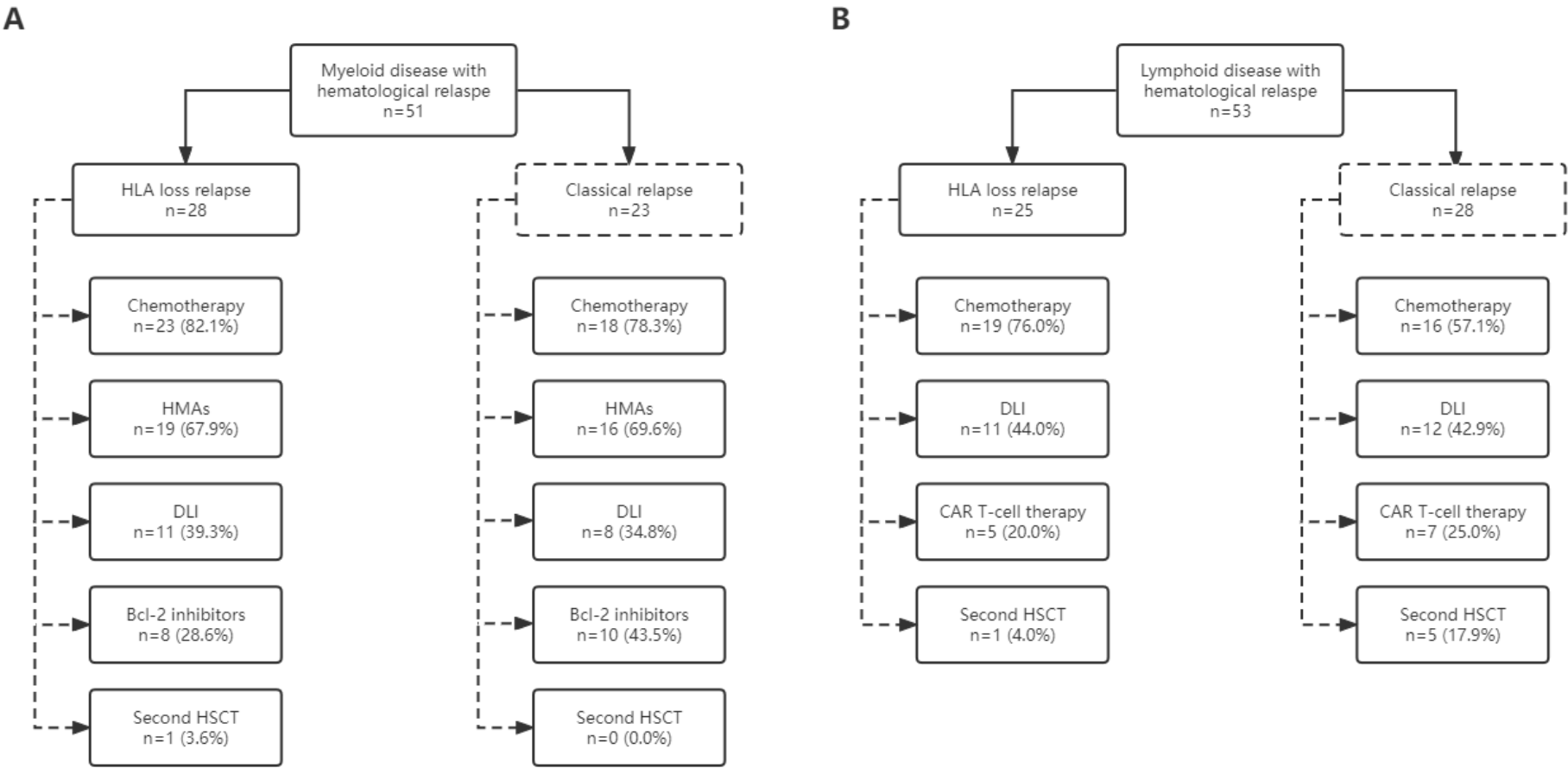
High-risk patients with MRD positivity might not prevent from relapse when using preemptive donor lymphocyte infusion (pDLI) in the (A) Loss Group and (B) Classical Group.



Abbreviation: HSCT, hematopoietic stem cell transplantation.

eFigure 2. Flowchart of Postrelapse Therapies

Post-relapse treatments for (A) myeloid disease and (B) lymphoid disease were presented



Abbreviations: DLI, donor lymphocyte infusion; HMA, hypomethylating agents; CAR, chimeric antigen receptor.