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Long-Term Survival after Transplantation of Unrelated Donor Peripheral Blood or Bone Marrow Hematopoietic Cells for Hematologic Malignancy

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A B S T R A C T

We sought to determine whether differences in chronic graft-versus-host disease (GVHD) rates would lead to survival differences by comparing 2463 peripheral blood (PB) and 1713 bone marrow (BM) hematopoietic cell transplant recipients. Patients had acute leukemia, chronic myeloid leukemia (CML), or myelodysplastic syndrome, and they received myeloablative conditioning regimens and calcineurin-inhibitor GVHD prophylaxis. There were no significant differences in long-term survival after transplantation of PB and BM, except for patients in first chronic phase CML. For these patients, the 5-year rate of survival was lower after transplantation of PB compared with transplantation of BM (35% versus 56%, $P = .001$). Although mortality risks were higher in patients with chronic GVHD after both PB (hazard ratio [HR], 1.58; $P < .001$) and BM (HR 1.73; $P < .001$) transplantations, its effect on mortality did not differ by graft type ($P = .42$). BM is the preferred graft for first chronic phase CML, whereas as either graft is suitable for other leukemias.

INTRODUCTION

Over the past decade, transplantation of peripheral blood hematopoietic cells (PB) has increased and now accounts for 75% of unrelated adult donor transplantations. The results of a phase III clinical trial that randomized 550 donors and their recipients to receive either PB or bone marrow (BM) from unrelated adult donors did not record significant 2-year survival differences between PB and BM transplant recipients [1]. However, the incidence of chronic graft-versus-host disease (GVHD) was higher and more severe after PB transplantation, requiring a longer duration of therapy compared with the incidence and severity after BM transplantation. The effect of long-term outcomes was not determined.

In HLA-matched sibling transplantation, long-term follow-up did not demonstrate significant survival differences between PB and BM transplantation for acute leukemia [2,3]. However, there were differences in long-term survival for those with chronic myeloid leukemia (CML) [2]. In that report, compared with transplantation of BM, survival rates were lower after transplantation of PB for patients who underwent transplantation in first chronic phase, but survival

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Table 1
Characteristics of Patients, Diseases, and Transplantation

Characteristics	BM	PB	*P* Value
No. of patients	1713	2463	
Age, yr			< .0001
18-29	501 (29%)	566 (23%)	
30-39	393 (23%)	515 (21%)	
40-49	473 (28%)	677 (27%)	
50-59	295 (17%)	573 (23%)	
60-70	51 (3%)	132 (5%)	
Sex, male	940 (55%)	1366 (55%)	.73
Performance score			<.0001
90-100	1075 (63%)	1498 (61%)	
< 90	440 (26%)	770 (31%)	
Not reported	198 (12%)	195 (8%)	
Recipient CMV serostatus			.11
Positive	964 (56%)	1406 (57%)	
Negative	738 (43%)	1026 (42%)	
Not reported	11 (1%)	31 (1%)	
Disease and disease status			<.0001
Acute myeloid leukemia			
First complete remission	258 (15%)	539 (22%)	
Second complete remission	225 (13%)	329 (13%)	
Relapse	299 (17%)	461 (19%)	
Acute lymphoblastic leukemia			
First complete remission	144 (8%)	256 (10%)	
Second complete remission	149 (9%)	194 (8%)	
Relapse	101 (6%)	151 (6%)	
MDS			
Refractory anemia	54 (3%)	92 (4%)	
RAEB (>5% blasts in bone marrow)	91 (5%)	146 (6%)	
CML			
First chronic phase	238 (14%)	116 (5%)	
Second chronic/accelerated phase	126 (7%)	143 (6%)	
Blast phase	28 (2%)	36 (1%)	
Donor-recipient HLA match			.04
8/8 HLA-matched	1273 (74%)	1901 (77%)	
7/8 HLA-matched	440 (26%)	562 (23%)	
Donor-recipient ABO match			<.0001
Matched	697 (41%)	927 (38%)	
Minor mismatch	411 (24%)	499 (20%)	
Major mismatch	491 (29%)	711 (29%)	
Not reported	114 (7%)	326 (13%)	
Donor-recipient sex match			.14
Female donor, male recipient	282 (16%)	418 (17%)	
Other	1414 (83%)	2003 (81%)	
Not reported	17 (1%)	42 (2%)	
Donor age, yr			.73
18-32	706 (41%)	941 (38%)	
33-50	806 (47%)	1051 (43%)	
> 50	79 (5%)	116 (5%)	
Not reported	122 (7%)	355 (14%)	
Conditioning regimen			<.0001
TBI + cyclophosphamide	1016 (59%)	1098 (44%)	
TBI + other agents	55 (4%)	192 (8%)	
Busulfan + cyclophosphamide	482 (28%)	793 (32%)	
Busulfan + fludarabine	160 (9%)	380 (15%)	
GVHD prophylaxis			<.0001
Tacrolimus-containing	1054 (62%)	1849 (75%)	
Cyclosporine-containing	659 (38%)	614 (25%)	
Cell dose per kilogram body weight			<.0001
TNC $<3 \times 10^8$/CD34 $< 4.5 \times 10^6$	934 (55%)	350 (14%)	
TNC $\geq 3 \times 10^8$/CD34 $\geq 4.5 \times 10^6$	635 (37%)	1526 (62%)	
Not reported	144 (8%)	587 (24%)	
Transplantation period			<.0001
2000-2004	1167(68%)	907 (37%)	
2005-2008	546 (32%)	1556 (63%)	
Follow-up, median (range), mo	73 (3-137)	61 (3-136)	

CMV indicates cytomegalovirus; TBI, total body irradiation; TNC, total nucleated cells.
Data presented are n (%) unless otherwise indicated.

was higher for those who underwent transplantation with more advanced disease [2].

In unrelated adult donor transplantations, it is uncertain whether with longer follow-up, the recorded higher incidence of chronic GVHD after PB transplantation will reduce survival. Financial constraints limit the follow-up of clinical trial recipients beyond the trial period, which is usually on the order of 2 years and insufficient to measure longer-term outcomes. Therefore, using data reported to the Center for International Blood and Marrow Transplant Research, we