

**Table 2. Pre-BMT Myeloablative Chemoradiotherapy Protocol**

Day	PEM-TBI		
-8	Cisplatin* 30 mg/m <sup>2</sup>	Etoposide* 100 mg/m <sup>2</sup>	
-7	Cisplatin 30 mg/m <sup>2</sup>	Etoposide 100 mg/m <sup>2</sup>	Melphalan 140 mg/m <sup>2</sup>
-6	Cisplatin 30 mg/m <sup>2</sup>	Etoposide 100 mg/m <sup>2</sup>	Melphalan 70 mg/m <sup>2</sup>
-5	Cisplatin 30 mg/m <sup>2</sup>	Etoposide 100 mg/m <sup>2</sup>	
-4	No therapy		
-3	TBI 3.33		
-2	TBI 3.33		
-1	TBI 3.33		
0	BMT†		

Abbreviation: PEM, cisplatin, etoposide, and melphalan.

\*Continuous 24-hour infusion daily for 4 days.

†Recipients of allogeneic BMT received methotrexate intravenously 5 mg/m<sup>2</sup> on days +1 and +4.

1991. Their characteristics at diagnosis and pre-BMT are listed in Table 3. With the exception of N-myc amplification, there was no significant difference between the two groups with regard to possible pretreatment prognostic factors at diagnosis, including age, stage, bone and bone marrow metastases, and surgery to primary tumor. However, there was an excess of patients with N-myc oncogene amplification in the allogeneic group (58%) compared with the autologous group (20%) ( $P = .027$ ). Pre-BMT characteristics were similar, although 45% of allogeneic patients achieved a complete remission (CR) by the time of BMT, compared with 28% of autologous patients (not significant). Using the newer international response criteria for neuroblastoma,<sup>17</sup> the total numbers in CR plus very good partial remission (VGPR) in the autologous group and the allogeneic group were virtually identical at 52% and 55%, respectively. The only significant difference at the time of BMT was the slightly shorter time from diagnosis to BMT in the allogeneic group (6.5 months) compared with the autologous group (7.8 months).

#### Time to Engraftment

Time to both neutrophil and platelet engraftment was significantly shorter after allogeneic than autologous BMT (Fig 1). The median time to absolute neutrophil count more than 500/ $\mu$ L for 3 consecutive days was 28 days (range, 10 to 72) for the autologous group (number assessable, 36) and 20 days (range, 12 to 36) for the allogeneic group (number assessable, = 17) (Fig 1A). No hematopoietic growth factors were used on this protocol. The time to platelet count more than 30,000/ $\mu$ L without

transfusion was 36 days (range, 16 to 100) for the autologous group (number assessable, 31) and 20 days (range, 11 to 59) for the allogeneic group (number assessable, 14) (Fig 1B).

#### Toxicity

There were four transplant-related deaths in the allogeneic group (20%), including two with sepsis, one pulmonary failure (patient with a history of prematurity and severe bronchopulmonary dysplasia, although pulmonary function was normal at the time of BMT), and one of venoocclusive disease. The three therapy-related deaths in the autologous group (8%) were due to infection, hemorrhage, and interstitial pneumonitis. Therapy-related deaths occurred a median of 35 days post-BMT (range, 9 to 85). There was no statistically significant difference in the occurrence of treatment-related deaths in the two groups. The specific grade 3 and 4 toxicities (National Cancer Institute common toxicity criteria) for the allogeneic and autologous groups are listed in Table 4. The predominant nonhematopoietic toxicity in both groups

**Table 3. Comparison of Patients Who Received Allogeneic Versus Autologous BMT**

Variable	Allogeneic		Autologous	
	No.	%	No.	%
<b>At diagnosis</b>				
No.	20		36	
Median age (years)	4.0		3.9	
Stage III*	3	15	3	8
Stage IV	17	85	33	92
Bone metastases	11	55	22	61
Bone marrow metastases	14	70	24	67
N-myc > 10	7/12	58	4/20†	20
Grossly resected primary	4	20	3	8
<b>Pre-BMT</b>				
Bone marrow positive before BMT‡	1	5	2	6
Bone marrow immunocytology positive before BMT§	3/10	30	6/36	17
Months to BMT (median)	6.5		7.8†	
<b>International response at BMT¶</b>				
CR	9	45	10	28
VGPR	2	10	9	25
PR	8	40	16	44
MR	1	5	1	3
Grossly resected primary	14	70	23	64
Local radiation to residual disease	7	35	26	72

Abbreviations: PR, partial response; MR, mixed response.

\*Stage III patients were only eligible if high risk, ie, N-myc > 10 or unfavorable histopathology or elevated ferritin level (> 142 ng/mL).

† $P < .05$ .

‡By conventional histology.

§Sensitivity of immunocytology, 1/100,000.

¶International response criteria.<sup>16</sup>