A retrospective case-matched analysis was performed comparing 188 myeloma patients treated with allogeneic bone marrow transplantation (allo-BMT) with an equal number of patients who received autologous stem cell transplantation (ASCT). Matching was performed with respect to gender, age, number of treatment lines before transplantation, the groups were comparable with the exception of median age (43 years for allo-BMT vs 49 years for ASCT, \(P = .0001\)) and median posttransplant follow-up (46 months for allo-BMT vs 30 months for ASCT, \(P = .0003\)). The overall survival was significantly better for ASCT than for allo-BMT, with a median survival of 34 months and 18 months, respectively (\(P = .001\)). However, this survival advantage was only observed in men, not in women. The statistically significant survival advantage for ASCT was seen in most subgroups, ie, chemotherapy-responsive patients, patients who had received two or more treatment lines before transplantation, patients in partial remission, patients with an IgG-subtype, patients older than 46 years of age, patients with stage II disease, and patients with a low or high serum β2-microglobulin at diagnosis. The main reason for the poorer survival in allo-BMT patients was higher transplant-related mortality (41% vs 13% for ASCT, \(P = .0001\)), which was not compensated for by a lower rate of relapse and progression. However, in patients alive at 1 year posttransplant, there was a trend for better long-term survival (\(P = .09\)) and significantly better progression-free survival (\(P = .02\)) for allo-BMT as compared with ASCT. We conclude that the median survival is superior for ASCT. However, allo-BMT has a lower relapse rate, which results in a similar long-term outcome for both approaches, but a longer follow-up is needed to assess the final outcome.

© 1996 by The American Society of Hematology.

From the Department of Medicine, Karolinska Institute and Huddinge Hospital, Huddinge, Sweden; the Department of Medical Statistics, University of Leiden, Leiden, The Netherlands; the Servicio de Hematología, Hospital de la Princesa, Madrid, Spain; the Department of Haematology, Hammersmith Hospital and Royal Postgraduate Medical School, London, UK; the School of Hematology, Hospital Clinic, Barcelona, Spain; the Department of Medicine, University Hospital, Upsala, Sweden; the Department of Haematology, Hospital San Orsola, Bologna, Italy; the Cliniques Universitaires St Luc, Brussels, Belgium; the Department of Haematology, University College Hospital, London, UK; the Department of Haematology, Hospital San Camilo, Rome, Italy; the Divisione di Ematologia, Ospedale V. Cervello, Palermo, Italy; the Department of Haematology, Addenbrooke’s Hospital, Cambridge, UK; the Department of Haematology, Royal Free Hospital, London, UK; the Department of Medicine, University Central Hospital, Turku, Finland; the Department of Haematology, Hospital Santa Creu i Sant Pau, Barcelona, Spain; the Department of Hematology, University Hospital, Utrecht, The Netherlands; and the Third Department of Medicine, University Central Hospital, Helsinki, Finland.

Submitted March 1, 1996; accepted July 31, 1996.

Supported by grants from the Swedish Medical Research Council and the Swedish Cancer Fund and by Grant No. BMH-1-CT94-0300 from the European Commission.

Address reprint requests to Bo Björkstrand, MD, PhD, Department of Medicine and Hematology, M54, Karolinska Institute at Huddinge Hospital, S-14186 Huddinge, Sweden.

The publication costs of this article were defrayed in part by page charge payment. This article must therefore be hereby marked "advertisement" in accordance with 18 U.S.C. section 1734 solely to indicate this fact.

© 1996 by The American Society of Hematology.

0006-4971/96/8812-0028/$3.00
Data on pretransplant patient characteristics are summarized in Table 1 and were comparable with the exception of median patient age at transplantation, which was significantly lower in the allo-BMT group (43 years v 49 years in the ASCT group, \( P = .0001 \)). The median posttransplant follow-up for survivors was 46 (range, 12 to 125) and 30 (range, 10 to 91) months for allo-BMT and ASCT, respectively \( (P = .0003 \).

**Pretransplant preparative regimen.** In the allo-BMT group, the pretransplant high-dose preparative regimen was total body irradiation (TBI) plus cyclophosphamide (CTX) in 140 patients; TBI plus CTX alone in 83 patients, TBI plus CTX and melphalan in 34, and TBI plus CTX with melphalan and/or other drug combinations in 23. Nine patients received TBI with drug combinations not containing CTX or melphalan. Forty allo-BMT patients received a preparative regimen without TBI, namely busulfan plus cyclophosphamide (BuCy) in 25 patients and BuCy plus other drugs in 5.

For the ASCT group, melphalan was included in the preparative regimen in 156 patients. Sixty-two patients received TBI plus melphalan alone whereas TBI plus melphalan and CTX was used in 20 patients; 35 patients were treated with melphalan as a single drug, and 39 received melphalan plus other drug combinations. Remaining ASCT patients received TBI plus CTX (10 patients), TBI plus etoposide (9), BuCy (9), or other drug combinations (5).

In general, the doses of the most commonly used chemotherapy agents were 120 mg/kg bodyweight of CTX, 140 to 200 mg/m\(^2\) of melphalan, and 16 mg/kg of busulfan. The scheduling of TBI for the 250 allo-BMT and ASCT patients who received TBI-containing regimens showed a great variation, in which unfractionated TBI was the single most common schedule used in 84 patients. TBI was used in 6 fractions in 48 patients and in 4 fractions in 38. The remaining 80 patients were fairly evenly distributed on different schedules of fractionated TBI, using between 2 and 24 fractions. The total doses of irradiation varied depending on the dosing schedule, but 163 patients received a total dose between 10 and 12 Gy, whereas 55 patients had a total dose of less than 10 Gy and 28 patients a total dose of more than 12 Gy. Information on the dose of TBI was lacking in 4 patients.

**Prevention of graft-versus-host disease (GVHD).** Treatment for the prevention of GVHD varied. Seventeen different combinations of T-cell depletion, cyclosporine, methotrexate, prednisone, and other drugs were used. The single most common combination was cyclosporin plus methotrexate, which was used in 82 patients. Other drug combinations without T-cell depletion were used in 40 patients. T-cell depletion, alone or combined with drugs, was used in 56 patients. Information was lacking in 11 patients. The different GVHD prevention regimens were fairly evenly distributed over time.

**Other procedural factors.** All 189 allo-BMT patients received a bone marrow graft. In the ASCT group, 72 patients received a bone marrow graft, 102 received a peripheral blood stem cell (PBSC) graft, and 15 patients received bone marrow plus PBSC. The autograft was purged in 1 patient, whereas the remaining 188 received unpurged grafts.

\( \alpha \)-Interferon maintenance treatment was administered to 96 patients after ASCT and to 9 patients after allo-BMT.

**Response criteria.** Complete remission (CR) was defined as the absence of detectable monoclonal Ig in serum or abnormal light chains in urine on conventional electrophoresis or immunofixation and less than 5% (of all nucleated cells) morphologically normal plasma cells in bone marrow on conventional cytologic analysis. Partial remission (PR) was defined as a decrease in the serum M-component that was more than 50% of the pretreatment value, a decrease in urinary light-chain excretion to less than 0.2 g per 24 hours, or both, combined with a hemoglobin level of more than 90 g/L, a serum albumin value of more than 30 g/L, and a serum calcium level of less than 2.61 mmol/L. Relapse (from CR) was defined as the reappearance of detectable paraprotein and/or recurrence of bone marrow infiltration. Progression was defined as a 50% increase in measurable paraprotein above plateau levels on two samples 4 weeks apart and/or an increase in bone marrow plasma cells on two samples 4 weeks apart.

**Statistics.** The 189 allo-BMT patients represent all matched sibling transplants performed from 1983 through 1994 that were completely reported to the EBMT Myeloma Registry in May 1995. ASCT patients for case matching were selected from a total number of 288 completely reported patients registered from 1986 through 1994. Case matching was performed with respect to patient gender and the number of different lines (1 or \( \geq 2 \)) of chemotherapy administered before the high-dose treatment. If more than one ASCT patient fulfilled the matching criteria for each allo-BMT patient, one patient was randomly assigned to the study.

Transplant-related mortality (TRM) over time was analyzed by dividing the allo-BMT group in four strata and the ASCT group in
For allo-BMT patients, the strata were patients transplanted between 1983 and 1987 (n = 44), 1988 and 1989 (n = 42), 1990 and 1991 (n = 53), and 1992 and 1994 (n = 50). For ASCT patients, the strata were patients transplanted between 1985 and 1989 (n = 35), 1990 and 1991 (n = 49), and 1992 and 1994 (n = 105).

All analyses have been computed using the SAS program (version 6.10; SAS Institute, Cary, NC) for Windows. Comparisons of frequencies between groups were performed using the $^2$ test. Median values were compared by Wilcoxon’s rank-sum test. Survival was estimated by the Kaplan-Meier product limit method, and curves were compared by the stratified log-rank test. All 378 patients were included in the analyses, but, in the graphic presentations, the survival curves have been cut by deleting the last 3 individuals on each curve.

RESULTS

Response rate. The overall response rate was significantly higher in the ASCT group (86% vs 72% for allo-BMT; $P = .001$). There was no significant difference between the allo-BMT and ASCT groups with respect to posttransplant CR rate (48% for allo-BMT vs 40% for ASCT, $P = .12$). The response was unfavorable in 20% of the patients in the allo-BMT group and in 6% after ASCT, which reflects the difference in early transplant-related death between the two groups. Concerning the matching criteria, the CR rate after allo-BMT was significantly higher in women (49% for allo-BMT vs 32% for ASCT, $P = .03$), whereas there was no significant difference between the groups with respect to male gender or the number of lines of chemotherapy. The posttransplant CR rate was significantly higher in the allo-BMT group for patients in stage I at diagnosis (79% for allo-BMT vs 42% for ASCT, $P = .006$). There was no significant difference in CR rate between the allo-BMT and ABMT groups with respect to other potential prognostic factors such as stage II or III at diagnosis, Ig subtype, and response status at transplantation.

Survival and progression-free survival (PFS). Overall survival (OS) for the whole patient group was significantly better for the ASCT group ($P = .001$, Fig 1), and the median survival posttransplant was 34 months and 18 months for the ASCT and allo-BMT groups, respectively. The difference between the survival curves was evident during the time up to 36 months after transplantation, by which time the curves tended to merge. PFS for all patients was also better for ASCT when analyzed with respect to the first 24 months posttransplant (Fig 1). Thereafter, curves crossed and followed each other closely. The survival difference in favor of autotransplantation was strongly pronounced for male patients ($P = .0003$), whereas no difference was seen for female patients (Fig 2). Survival data for the different prognostic subgroups are summarized in Table 2.

For patients in CR, there was no significant difference in OS or FFS between the allo-BMT and ASCT groups (Fig 3), although the curves showed a tendency to part with time in favor of allo-BMT. The median time until relapse was significantly shorter in the ASCT group (23 months vs 56 months for allo-BMT, $P = .02$; data not shown).

In an attempt to correct for the difference in posttransplant follow-up time, patients transplanted during the contemporary period from 1986 and onwards were compared by excluding the 15 allo-BMT patients transplanted before 1986 and thus comparing the remaining 174 allo-BMT patients with their respective matched ASCT-controls. Even so, the significant survival advantage for ASCT was sustained (median OS, 17 months for allo-BMT vs 35 months for ASCT, $P = .0002$). The median FFS was 10 months for allo-BMT versus 18 months for ASCT, but, because these curves later crossed, the statistical significance cannot be correctly evaluated. The survival and FFS curves of the time-corrected analysis are practically superimposable with those for all patients analyzed (Fig 1).

Relapse/progression rate and myeloma-related mortality. The rate of relapse from CR or progression from PR was significantly higher in the ASCT group ($P = .04$), in which the relapse/progression rate at 48 months was 70%, compared with 30% for the allo-BMT group (Fig 4). Forty-two allo-BMT patients (22%) and 66 ASCT patients (35%) have died from progressive myeloma ($P = .006$).

GVHD. One hundred seventy-five patients in the allo-BMT group could be evaluated for acute GVHD. It was absent in 57 patients, whereas 101 had grade I-II and 17 had grade III-IV.

TRM. TRM was significantly higher in the allo-BMT group (41% at 36 months after transplantation vs 13% in the ASCT group, $P = .0001$, Fig 4). In the allo-BMT group, the causes of death were interstitial pneumonitis in 19 patients, infection in 18, GVHD in 17, hemorrhage in 7, organ failure in 5, veno-occlusive disease of the liver (VOD) in 4, respiratory distress syndrome in 3, cardiac complications in 2, capillary leak syndrome in 1, and graft rejection in 1. In the ASCT group, 7 patients died of interstitial pneumonitis, 7
Fig 2. Probability of OS for (A) male and (B) female patients. The curve with the thicker line indicates the ASCT group. A P value cannot be given in (B) because the curves cross and therefore the log-rank test cannot be applied.

Fig 3. Probability of (A) OS and (B) duration of remission for patients in complete remission after transplantation. The curve with the thicker line indicates the ASCT group. P values cannot be given because the curves cross and therefore the log-rank test cannot be applied.

Table 2. Prognostic Factors Analyzed for Their Potential Impact on Survival and PFS From the Time of Transplantation in the Comparison Between Allo-BMT and ASCT

<table>
<thead>
<tr>
<th>Group Analyzed (no. allo/no. auto)</th>
<th>Median Survival (confidence interval in Months)</th>
<th>Median PFS (confidence interval in Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (112/112)</td>
<td>16 (9-27)</td>
<td>31 (26-45)</td>
</tr>
<tr>
<td>Female (77/77)</td>
<td>31 (18-58)</td>
<td>36 (25-∞)</td>
</tr>
<tr>
<td>1 line of chemotherapy (76/76)</td>
<td>31 (11-86)</td>
<td>41 (31-∞)</td>
</tr>
<tr>
<td>≥2 lines of chemotherapy (113/113)</td>
<td>14 (7-26)</td>
<td>29 (24-43)</td>
</tr>
<tr>
<td>Age &lt;46 yr (131/131)</td>
<td>18 (8-31)</td>
<td>33 (24-45)</td>
</tr>
<tr>
<td>Age ≥46 yr (68/131)</td>
<td>17 (6-41)</td>
<td>35 (28-66)</td>
</tr>
<tr>
<td>Responsive to chemotherapy (143/143)</td>
<td>17 (8-31)</td>
<td>37 (29-66)</td>
</tr>
<tr>
<td>CR at transplant (27/21)</td>
<td>18 (5-86)</td>
<td>31 (22-∞)</td>
</tr>
<tr>
<td>PR at transplant (117/122)</td>
<td>17 (6-33)</td>
<td>37 (29-∞)</td>
</tr>
<tr>
<td>Responsive/1 line of chemo (62/69)</td>
<td>31 (10-86)</td>
<td>41 (31-∞)</td>
</tr>
<tr>
<td>Unresponsive to chemotherapy (44/43)</td>
<td>18 (6-41)</td>
<td>20 (9-29)</td>
</tr>
<tr>
<td>IgG subtype (97/110)</td>
<td>8 (6-21)</td>
<td>32 (28-52)</td>
</tr>
<tr>
<td>Non-IgG subtype (92/79)</td>
<td>18 (5-49)</td>
<td>33 (19-∞)</td>
</tr>
<tr>
<td>Stage I (28/24)</td>
<td>66 (17-∞)</td>
<td>67 (29-∞)</td>
</tr>
<tr>
<td>Stage II (39/58)</td>
<td>10 (3-41)</td>
<td>NR (37-∞)</td>
</tr>
<tr>
<td>Stage III (122/126)</td>
<td>17 (7-31)</td>
<td>28 (24-33)</td>
</tr>
<tr>
<td>β2m &lt;4 mg/L (37/53)</td>
<td>58 (16-81)</td>
<td>66 (44-∞)</td>
</tr>
<tr>
<td>β2m ≥4 mg/L (25/27)</td>
<td>5 (3-18)</td>
<td>22 (13-43)</td>
</tr>
<tr>
<td>CR posttransplant (90/75)</td>
<td>66 (33-88)</td>
<td>35 (25-52)</td>
</tr>
</tbody>
</table>

Abbreviation: t, the curves crossed; therefore, the significance analysis (stratified log-rank test) cannot be applied and no P value can be given.
STEM CELL TRANSPLANTATION IN MULTIPLE MYELOMA

4715

A

n=189

p=0.04

B

n=189

p=0.0001

Fig 4. Probability of incidence of (A) myeloma relapse/progression and (B) transplant-related mortality for all patients. The curve with the thicker line indicates the ASCT group.

of infection, 4 of hemorrhage, 2 of organ failure, 2 of VOD, and 1 of capillary leak syndrome.

TRM over time was unchanged for the allo-BMT group, with a TRM rate of 40% during 1983 through 1987 and 1988 through 1989, 45% in 1990 through 1991, and 38% in 1992 through 1994. However, in the ASCT group, TRM improved with time, with a TRM rate of 35% in 1986 through 1989, 10% in 1990 through 1991, and 7% in 1992 through 1994.

For patients alive at 1 year posttransplant, the median OS was 81 months after allo-BMT, compared with 46 months after ASCT (P = .09, Fig 5), and the median PFS was 41 and 24 months for allo-BMT and ASCT, respectively (P = .02; Fig 5).

DISCUSSION

This case-matched, comparative study of allo-BMT and ASCT in multiple myeloma shows that outcome with respect to OS is better after ASCT. The main reason for this is the higher rate of TRM in the allo-BMT group, which is not compensated for by the lower relapse rate. This can be compared with another chronic hematologic malignancy in which allo-BMT is frequently used, ie, chronic myeloid leukemia in first chronic phase (CML-CP), in which a registry analysis of long-term results in 947 patients receiving HLA-identical sibling marrow showed that the TRM was about 35%, ie, similar to myeloma, but the relapse incidence in CML was much lower (about 25% when a non-T-cell–depleted bone marrow graft is used). Thus, the fundamental problem in multiple myeloma seems to be high resistance to cytotoxic mechanisms, resulting in great difficulty in achieving complete eradication of the disease.

A high TRM continues to be a major issue after allo-BMT for multiple myeloma, despite continuous development in the treatment of complications. In the present study, TRM showed no tendency to improve with time. A similar comparison in CML-CP shows that TRM has been reduced to 20% in patients transplanted after 1988. The TRM rate in this study is naturally similar to previously reported surveys of the patient material from the EBMT group and is also consistent with the results from two of the three published major single-center studies of allogeneic BMT in multiple myeloma, ie, from the Seattle group (39 patients, TRM of 48%) and Bologna (35 patients, TRM of 51%). In the third study, from the Dana-Farber Cancer Institute, comprising 15 patients who received T-cell–depleted allografts, the TRM was only 15%. Some patients with multiple myeloma could be expected to be in a bad performance status, which would render them more susceptible to transplant-related complications. However, probability for survival at 1 year posttransplant was about 50% to 55%, both for allo-BMT patients transplanted after receiving two or more lines of chemotherapy, ie, in more long-standing disease, and for patients who had their allo-BMT in early disease, ie, first responsive phase (data not shown). This finding indicates that factors other than performance status are also important to explain the high TRM and the lack of improvement as compared with CML-CP. PBSC autografting is associated with a more rapid engraftment as compared with autologous BMT, and the extensive use of PBSC grafts for ASCT might have reduced the rate of neutropenic complications in this group. However, it is not likely that the difference in the main source of the graft between the allo-BMT and ASCT groups could explain the difference in TRM, because previous studies have not shown any survival advantage for autolo-
mous PBSC transplantation when compared with autolo-
gous BMT.24,25

An interesting observation is that female allo-BMT recipi-
ents have a better outcome than male recipients, mainly
due to a lower incidence of early posttransplant mortality.17 How-
ever, in the present study, OS and PFS for female patients
was similar but still not superior to that of the ASCT group.
The reason for the female survival advantage after allo-BMT
remains unclear. No influence of the donor-recipient rela-
tionship with respect to gender could be shown in the present
study, although this has been shown to be of importance in,
eg. CML-CP.19

One important argument for allo-BMT in myeloma is the
possible potential of cure. In the allo-BMT group, 9 patients
remain in CR more than 5 years after transplantation, com-
pared with 4 patients after ASCT, and the maximum duration
of continuous CR is 113 months and 79 months for allo-
BMT and ASCT, respectively. However, the comparison is
hampered by the fact that the follow-up time after ASCT is
shorter than that after allo-BMT. Other published ASCT
studies have a similar or shorter follow-up.1,4,5,26 Minimal re-
sidual disease in myeloma has, in some cases, disappeared
beyond the detection level of the polymerase chain reaction,
both after allo-BMT and ASCT, but in a few of these cases
the disease has nevertheless recurred.10,16 Late relapses do
take place, and, in the present study, the latest relapses oc-
curred after a CR duration of 38 months for ASCT and 91
months for allo-BMT, respectively. However, the fact that
the time until disease relapse or progression was significantly
longer after allo-BMT compared with ASCT in patients alive
at 1 year after transplantation indicates that the allogeneic
graft per se may have some beneficial effect on the disease,
which is probably lacking in ASCT, and the existence of
such a graft-versus-myeloma effect has recently been di-
rectly shown.22 However, in a recent EBMT survey describ-
ing the majority of the allo-BMT patients also analyzed in
the present study, the relapse rate in patients with no GVHD
and in those with GVHD grade I-II was similar.17 It is pos-
ible that a more equal long-term follow-up may result in an
emerging advantage for allo-BMT with time, but, to date,
no definite conclusions can be drawn in the comparison be-
 tween the allo-BMT and ASCT groups with respect to long-
term CR, and there is still no evidence for cure in multiple
myeloma.

Is there any evidence that high-dose treatment with stem
 cell rescue is better than conventional chemotherapy? A clear
 survival benefit has previously been hard to show in uncon-
trolled studies, but in a recent controlled, randomized trial
in patients with newly diagnosed myeloma receiving first-
line treatment, high-dose melphalan plus TBI followed by
autologous BMT was shown to be significantly superior to
conventional chemotherapy with respect to OS and PFS.18
Similar data for allo-BMT are still lacking. Concerning addi-
tional transplant-related strategies, there are preliminary data
indicating that posttransplant α-interferon maintenance treat-
ment may prolong survival after ASCT28,29; in the present
study, 50% of the ASCT patients received such treatment.
Similar data for allo-BMT are lacking, which in the present
study is reflected by the fact that only 9 allo-BMT patients
were treated with α-interferon.

To conclude, high-dose treatment with stem cell rescue
can improve long-term survival and induce long periods of
unmaintained disease control for younger patients with mul-
tiple myeloma. In the present study, no advantage could be
shown for allo-BMT in general. Early survival was better
for ASCT, whereas the relapse rate was higher. We also
failed to show any prognostic subgroup in which allo-BMT
was more beneficial, although there was no survival differ-
ence for female patients. As far as allo-BMT is concerned,
the primary issue would be attempts to reduce the early
mortality rate that would be likely to improve long-term
results. Potential ways to reduce TRM include further im-
provements in GVHD prophylaxis and the use of allogeneic
PBSC, although the early studies of the latter strategy are
as yet limited to a demonstration of feasibility and indica-
tions of a reduction in the time to engraftment.30,31 The sec-
ondary goal would be to decrease the still substantial relapse
rate, eg, by posttransplant immunotherapy with donor lym-
phocytic transfusions,27 a strategy that has been successful
to impede clinical relapse in CML.32 However, it remains to
be seen if the lower relapse rate after allo-BMT will result in
a higher proportion of ultimately cured patients. For ASCT,
future intensification by means of repeated treatment cycles
have yielded promising results in pilot studies.8,10 A con-
trolled randomized trial to compare one and two cycles of
high-dose treatment followed by ASCT is currently being
undertaken by the French Myeloma Study Group. Despite
this progress, the results of treatment for multiple myeloma
remain unsatisfactory, and an uncertain possibility of cure
could only be offered a small number of patients. The current
strategies with high-dose therapy are therefore hopefully not
the final answers to myeloma treatment. More directed and
effective treatment methods are warranted, and new ap-
proaches, including gene therapy33 and immunotherapy,24 are
under development.

ACKNOWLEDGMENT

We thank the following centers and the physicians that have par-
ticipated in the study by reporting patients to the Myeloma Registry
at Huddinge Hospital: Kantonsspital, Basel, Switzerland (A. Grat-
wohl); Universität Ulm, Ulm, Germany (H. Heimpel); Institute Jules
Bordet, Brussels, Belgium (L. Debusscher); Ospedale San Martino,
Genoa, Italy (A. Bacigalupo); Royal Marsden Hospital, Sutton, Sur-
rey, UK (R.L. Powles); Ospedale la Sapienza, Rome, Italy (W. Ar-
ce); Hôpital Jean Minjoz, Besançon, France (M. Flesch); Univer-
sity Hospital St Radboud, Nijmegen, The Netherlands (A.
Schattenberg); Dr Daniel den Hoed Cancer Center, Rotterdam, The
Netherlands (J.J. Cornelissen); Hôpital César, Caen, France (X.
Troussard); Hôpital Henri Mondor, Creteil, France (J.P. Vernant);
Hôpital Dieu, Nantes, France (J.L. Harousseau); Christian-Albrechts
University, Kiel, Germany (N. Schmitz); University Hospital, Essen,
Germany (K. Quabbeck); HCUG, Geneva, Switzerland (B. Chupitis);
the London Clinic, London, UK (M. Finn); CHR Bordeaux, Pessac,
France (J. Reiffers); Royal London Hospital, London, UK (A.C.
Newland); Hôpital A. Michallon, Grenoble, France (F. Nicolli);
University Hospital, Innsbruck, Austria (D. Niederwieser); Royal
Victoria Infirmary, Newcastle, UK (S. Proctor); Hôpital Cochin,
Paris, France (C. Belanger); University Hospital, Lund, Sweden (S.
Lenhoff); Policlinico San Matteo, Pavia, Italy (E.P. Alessandrino);
Medical School, Hannover, Germany (H. Link); Institute Portugues
Oncologia, Lisboa, Portugal (A. Machado); Ospedale di Careggi.
REFERENCES


16. Bjorkstrand B: 474 autotransplants in multiple myeloma—Results of the EBMT. Fifth International Workshop on Multiple Myeloma. La Baule, France, 1995, p 3.32


first remission induction treatment in multiple myeloma. Bone Marrow Transplant 15:963, 1995


Allogeneic bone marrow transplantation versus autologous stem cell transplantation in multiple myeloma: a retrospective case-matched study from the European Group for Blood and Marrow Transplantation


Updated information and services can be found at:
http://www.bloodjournal.org/content/88/12/4711.full.html

Articles on similar topics can be found in the following Blood collections

Information about reproducing this article in parts or in its entirety may be found online at:
http://www.bloodjournal.org/site/misc/rights.xhtml#repub_requests

Information about ordering reprints may be found online at:
http://www.bloodjournal.org/site/misc/rights.xhtml#reprints

Information about subscriptions and ASH membership may be found online at:
http://www.bloodjournal.org/site/subscriptions/index.xhtml