SCIENTIFIC PAPER

A brief introduction of the Chinese Marrow Donor Program

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The Data Bank of Chinese Hematopoietic Stem Cell Donors (Chinese Marrow Donor Program, CMDP) is operated under the guidance of Red Cross Society of China. It is in charge of the administration of propagation, organisation, mobilisation of volunteers, and the standardisation of human leukocyte antigen (HLA) typing, preliminary search, clinical transplantation, and all related activities in unrelated stem cell transplantation in China. The Advisor Committee—composed by experts in the fields of haematopoietic stem cell transplantation (HSCT), HLA typing, legislation, information technology and ethics—guides the development of the CMDP. The budget of CMDP mainly comes from funds of National Charity Lottery and other charities. Up to the end of 2008, 31 branch registries and HLA-typing laboratories, five high-resolution laboratories, and one quality-control laboratory were established and authorised. There are more than 950 000 donors in our data pool. The CMDP has established clinical relationship with over 100 hospitals. More than 1100 CMDP donors have donated peripheral blood stem cells to patients successfully. The CMDP has also signed cooperation agreement with five of the seven major cord blood banks in mainland China. As a result, there are over 30 000 units of cord blood available for searching in our system. This will improve the matching and using rate of cord blood. The emergence of the CMDP has filled a void in mainland China's contribution to clinical HSCT and donor search worldwide. It has performed preliminary searches for overseas patients including Taiwan, Hong Kong, Macao, United States, Britain, Canada, France, Italy, Germany, Japan, Korea and Singapore, and over 50 donations have been completed.

Introduction

The Data Bank of Chinese Hematopoietic Stem Cell Donors, also known as the Chinese Marrow Donor Program (CMDP), is a non-profit organisation under the umbrella of the Red Cross Society of China. Established in 1992 and subsequently reactivated in 2001, CMDP's mission is to regulate and administer marrow donor recruitment, human leukocyte antigen (HLA) typing and marrow transplantation for genetically matched donors in China. It is in charge of activities including the administration of propagation, organisation, mobilisation of volunteers, and the standardisation of HLA typing, preliminary search, clinical transplantation, and all related activities in unrelated stem cell transplantation in China. The Advisor Committee—composed by experts in the fields of haematopoietic stem cell transplantation (HSCT), HLA typing, legislation, information technology and ethics—guides the development of the CMDP. The budget of CMDP mainly comes from funds of National Charity Lottery and other charities. Up to the end of 2008, 31 branch registries and HLA-typing laboratories, five high-resolution laboratories, and one quality-control laboratory were established and authorised.

Key words
Blood banks; Bone Marrow Transplantation; China; Cord blood stem cell transplantation; Registries

Hong Kong Med J 2009;15 (Suppl 3):45-7

Declaration
The authors did not receive grants or outside funding in support of their research for or preparation of this manuscript. They did not receive payments or other benefits, or a commitment or agreement to provide such benefits from a commercial entity.

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Growth in donor pool

The year 2008 was a remarkable year for China. We held a successful Olympic Games but also endured tumultuous snowstorms and the Sichuan earthquake. China has also been severely affected by the global financial crisis. The CMDP team, just like all fellow Chinese citizens, worked hard to cope with these challenging events facing the nation. In 2008, CMDP achieved great progress towards its goals. A total of 170 000 new donors were registered within this single Olympic year, bringing its total to more than 950 000, thereby making CMDP the world's third largest registry of its kind. Figure 1 shows the trend of total number of donor registration from 2002 to 2008. In 2002, CMDP only have 6000 donors, but until the end of 2008, the number has risen to 950 000. The CMDP has also signed cooperation agreement with five of the seven major cord blood banks in mainland China. As a result, there are over 30 000 units of cord blood available for searching in our system. This will improve the matching and using rate of cord blood.

In the CMDP data pool, 55% donors are male, and 45% are female. In China, ethnic minorities make up 9.44% of the population, and in CMDP, 6% of donors come from minority

中國造血幹細胞捐獻者資料庫簡介

中國造血幹細胞捐獻者資料庫（簡稱「中華骨髓庫」，英文縮寫CMDP），是在中國紅十字會領導下開展工作的。主要負責統一管理和規範開展志願捐獻者的宣傳、組織、動員、HLA（人類白細胞抗原）分型、為患者檢索相合的志願捐獻者及移植治療服務等。由移植、HLA檢測、法律、倫理和IT方面專家組成的專家委員會在中華骨髓庫的建設中起到了技術指導和把關的作用。骨髓庫建設的資金來源主要是國家彩票公益金，還有一些社會資助。截至2008年底，在大陸31個省份建立了分庫，認定了一批定點組織配型實驗室，5個高分辨實驗室和1個質控實驗室；可用於為患者檢索服務的HLA分型資料95萬多人份；與國內外百餘家醫院建立了業務聯系，1100多位志願者為患者捐獻了造血幹細胞。為方便患者查詢，中華骨髓庫與國內7家臍血庫中的5家簽訂了合作協議，將30　000餘份臍血資料納入中華骨髓庫的查詢系統，提高配型相合的幾率和臍帶血造血幹細胞的使用率。中華骨髓庫已初步顯現在臨床使用上的意義，其建設彌補了大陸地區造血幹細胞移植事業發展的空白。此外，中華骨髓庫的建設還產生了良好的國際影響，為包括台、港、澳地區和美國、英國、加拿大、法國、意大利、德國、日本、韓國、新加坡等20多個國家的患者提供了檢索查詢服務，其中50多名捐獻者為國（境）外患者捐獻了造血幹細胞。

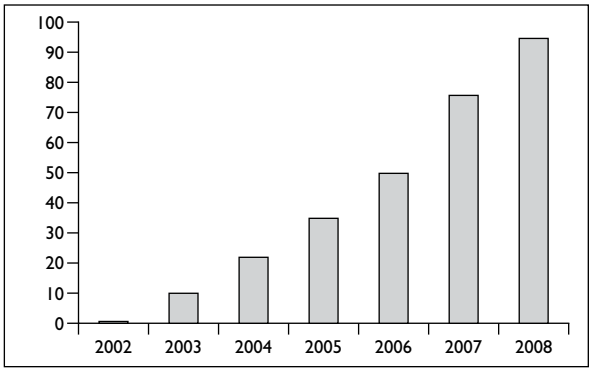

FIG 1. Growth in total number of donors by year

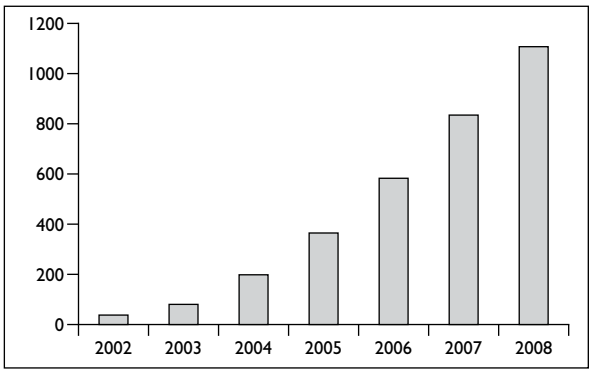

FIG 2. Growth in total number of transplants performed by year

ethnic groups, while 94% come from Han Chinese. More than 79% donors in CMDP are young individuals from 18 to 35 years old, while patients from ages 36-45, 46-55 and over 55 years comprised only 19.2%, 4.5% and 0.15% of the pool, respectively.

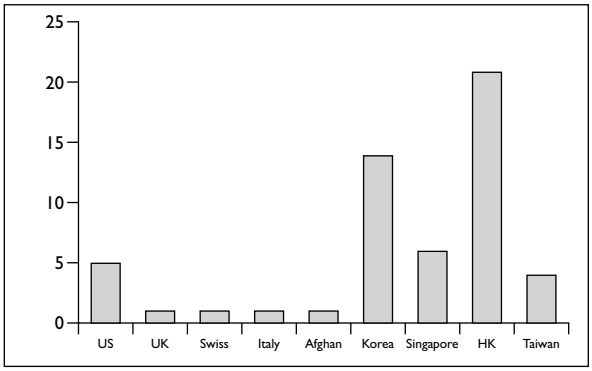

FIG 3. Distribution of destination of 54 stem cell units delivered to overseas

Growth in stem cell delivery

Until the end of 2008, a total of 1117 peripheral blood stem cell (PBSC) donations were provided by CMDP (Fig 2), serving more than 100 transplants centres all over the world. In 2008 alone, 275 transplants were completed, hence crossing the 1000 landmark in July 2008. The CMDP also helped identify matching donors for overseas patients from countries, including the United States, Canada, Singapore, the United Kingdom, France, Germany, Australia, Norway and Japan, as well as from Taiwan and Hong Kong. More than 50 transplants were successfully completed for overseas patients, including Hong Kong (n=21), Korea (n=14), Singapore (n=6), Taiwan (n=4), United States (n=5), United Kingdom, Switzerland, Italy and Afghanistan (n=1 each) [Fig 3].

Clinical outcome of transplants from Chinese Marrow Donor Program stem cells

With increasing number of clinical procedures performed, it becomes increasingly important to conduct follow-up surveys on both donors and patients post-transplantation. Follow-up surveys were completed on 822 CMDP stem cell recipients during 1996-2007. A preliminary summary showed an overall 100-day and 1-year survival of 75.8% and 63.1% respectively (Table 1). Further analysis showed a gradual annual improvement in the overall survival from 54 to 71% over the recent years. The number of male recipients outnumbers female recipients by 1.8 to 1. There were, however, no apparent differences in both early and 1-year survival rates between the genders. Most recipients were aged between 21 and 30 years (35% of cases), but HSCT were performed for both younger and older cases. The results were marginally inferior for patients transplanted at ages 41 years or above (Table 1).

TABLE 1. Overall survival (OS) after haematopoietic stem cell transplantation at 1 year (by year, gender, and age-group)

	No. of cases	No. of survivors	OS (%)
By year			
1996-2003	79	43	54
2004	119	63	53
2005	168	101	60
2006	215	140	65
2007	241	172	71
Total	822	519	63
By gender	**No. of cases**	**100-Day OS (%)**	**OS (%)**
Male	532 (65%)	78.2	65.0
Female	290 (35%)	79.0	63.1
Total	822	78.5	63.1
By age-group (years)			
51-60	34 (4%)	67.6	50.0
41-50	129 (16%)	72.1	54.3
31-40	211 (26%)	82.5	63.9
21-30	289 (35%)	77.2	66.1
11-20	131 (16%)	81.7	64.1
≤10	28 (3%)	89.3	78.6
Total	822	78.5	63.1

TABLE 2. Overall survival (OS) by (a) degree of HLA matching using high-resolution polymerase chain reaction methods from 2006 to 2007, and (b) disease entities from 1996 to 2007

	No. of cases	100-Day OS (%)	1-Year OS (%)
HLA matching			
Full match (10/10)	214	84.1	69.6
1 Antigen mismatch (9/10)	158	81.6	72.2
2 Antigen mismatch (8/10)	50	82.0	62.0
3 Antigen mismatch (7/10)	25	76.0	56.0
4 Antigen mismatch (6/10)	6	100	66.7
5 Antigen mismatch (5/10)	3	0	0
Total	456	82.2	68.4
Diagnosis			
CML	295	78.9	64.7
ALL	240	77.9	59.2
AML	186	79.6	65.1
NHL	6	100	83.3
ANLL	18	72.2	55.6
SAA	14	71.4	64.3
Aplastic anaemia	8	62.5	62.5
MPD	27	88.9	70.4
Thalassaemia major	9	77.8	77.8
HD	8	37.5	37.5
AL mixed lineage	3	66.7	66.7
SCID	2	100	100
Myekoma	1	100	100
CLL	1	100	100
Osteopetrosis	1	100	100
LPD	1	100	100
Granulocytic sarcoma	1	0	0
Mucopolysaccharidosis	1	100	100
Total	822	78.5	63.1

* CML denotes chronic myeloid leukaemia, ALL acute lymphoblastic leukaemia, AML acute myeloid leukaemia, NHL non-Hodgkin's lymphoma, ANLL acute non-lymphoblastic leukaemia, SAA severe aplastic anaemia, MPD myeloproliferative disorder, HD Hodgkin's disease, AL acute leukaemia, SCID severe combined immunodeficiency disease, CLL chronic lymphatic leukaemia, and LPD lymphoproliferative disorder

Since 2006, high-resolution HLA typing at 10 loci has been provided by the CMDP for matching purposes. Very few cases were released with HLA matching below seven loci and 10/10 matching was achieved for 47% of cases. The results from our survey showed that day-100 and 1-year overall survivals were comparable between cases with 10/10 and 9/10 matches, while the 1-year survival still reached 56 to 62% for patients with 2 to 4 HLA antigen mismatches. However, further analysis was precluded by the small number of cases, the lack of details on clinical progression, and the complexity of the exact nature and direction of the HLA allele mismatch (Table 2).

Data were also available for the indication for unrelated donor HSCT and the subsequent survival of each disease group (Table 2). The majority of procedures were performed for chronic myeloid leukaemia (CML, 36%), acute lymphoblastic leukaemia (29%), and acute myeloid leukaemia (including cases registered as non-lymphoblastic and mixed lineage leukaemia, myelodysplasia and granulocytic sarcomas 25%). These three indications make up 90% of case requests. Fewer cases were performed for mature lymphoid malignancies. Other minor indications included thalassaemia major and aplastic anaemia. With the advent of tyrosine kinase inhibitors, the number of referrals for patients with CML is expected to decline. There were no apparent differences in early and late survivals among the major disease categories.

Conclusions

The CMDP registry will grow to reach the one millionth registered donor in 2009. We hope to be on course to reach the two millions mark within the next 5 years. In order to construct a first-rate registry and to benefit Chinese worldwide, CMDP has taken great efforts to enhance the cooperation and exchanges with overseas colleagues, and to provide the best search service. We hope to be able to serve the need for life-saving stem cell provision for as many ethnic Chinese in China, and all over the world, as possible.