percentage of apoptotic cells was detected (7-amino-actinomycin D [7AAD]) at P2 until P10. MSCs were resistant to apoptosis under serum-deprivation conditions. The expression of the cell cycle genes studied was not statistically different compared with controls, and cells did not grow on soft agar.

CONCLUSIONS: MSCs isolated from BM of children retain their characteristics for a serial number of passages and survive under serum-deprivation conditions, a necessary process in a transplantation setting. The cells do not have oncogenic properties, as shown by normal expression levels of oncogenes and tumor suppressor genes, and no growth on soft agar. These findings enhance the use of MSCs in clinical applications.

NDRG1 EXPRESSION IN CHILDHOOD LEUKEMIA AND ITS CORRELATION TO PROGNOSIS AND THERAPEUTIC RESPONSE

Submitted by Ju Gao

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INTRODUCTION: N-myc downstream regulated gene 1 (*NDRG1*) gene expression has been found to be downregulated in a variety of solid tumors and is now regarded as a suppressor gene. However, little is known about its possible role in hematologic cancers.

OBJECTIVE: Our goal was to study expression of the *NDRG1* gene in childhood leukemia and explore a possible correlation between expression and prognostic factors.

METHODS: Bone marrow or peripheral blood mononuclear cells from 65 children with leukemia and peripheral blood mononuclear cells from 12 healthy control children were isolated: *NDRG1* messenger RNA expression was determined by fluorescence real-time polymerase chain reaction.

RESULTS: *NDRG1* messenger RNA expression in acute leukemia groups collectively (acute lymphocytic leukemia [ALL] [41 cases] and acute monocytic leukemia [24 cases]) was significantly lower than that of normal controls (normalized ratios of *NDRG1* to glyceraldehyde-3-phosphate dehydrogenase copy numbers were 0.27 and 0.25 vs 0.30 and 0.86 in controls, respectively; $P < .01$), although there was no statistically significant difference between the ALL and acute monocytic leukemia groups. *NDRG1* expression was significantly lower in prednisone nonresponder ALL (13 cases) than in prednisone good-responder ALL (15 cases) (normalized ratios: 0.13 and 0.38, respectively). Similarly, *NDRG1* expression was significantly downregulated in high-risk ALL (17 cases) than that in lower-risk ALL (24 cases) (normalized ratios: 0.15 and 0.30, respectively).

CONCLUSIONS: *NDRG1* expression was remarkably downregulated in childhood leukemia, as in other human solid tumors. In addition, its expression in childhood ALL was closely associated with such prognostic factors as prednisone response and risk stratification. Our research suggests that *NDRG1* expression is negatively correlated to ALL prognosis and therapeutic response.

IMMUNE STATUS AND IMMUNE RECOVERY IN CHILDREN WITH LYMPHOMA AT THE END OF THERAPY (CHEMOTHERAPY AND/OR RADIOTHERAPY) AND IN FOLLOW-UP EVALUATIONS

Submitted by Helen Kosmidis

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OBJECTIVE: We aimed to evaluate the immune status and immune recovery after completion of chemotherapy and/or radiotherapy in children with lymphoma.

METHODS: We prospectively evaluated humoral and cellular immunity in 22 children with lymphoma (11 with Hodgkin's disease [HD] and 11 with non-Hodgkin's lymphoma [NHL]) at the completion of therapy and every 6 months thereafter.

RESULTS: Immunoglobulin (Ig) levels were normal before the onset of therapy in all but 1 child. At the end of therapy, Ig levels decreased: IgM in 18, IgG in 12, and IgA in 7 children. In addition, 17 of 22 had decreased CD19 levels. In HD after radiotherapy, IgG and CD19 levels increased significantly ($P = .013$ and .004, respectively). IgM levels remained abnormally low in 16 of 22 children up to 18 months after therapy completion. At the end of therapy, helper T lymphocyte (CD4) levels were low in 20 of 22 children, and suppressor (CD8) levels were elevated in 13 of 22 children. (For those with HD before radiotherapy, the CD8 level was high in 10 of 11 children, and the CD4 level was low in 6 of 11 children.) The suppressor CD8 level remained elevated in 12 of 20 children, and helper CD4 level remained abnormally low in 18 of 20 children for a period of 6 to 18 months after therapy. Some immunized children became nonimmune to polio (15 of 22), mumps (6 of 22), rubella (5 of 22), and measles (1 of 22).

CONCLUSIONS: In children with lymphoma, IgM levels remained low for long periods. Helper T lymphocyte levels were low and suppressor levels were

high at the end of therapy. Suppressor cells normalized faster, whereas helper cell levels remained abnormally low for a long period. Most children became nonimmune to polio, whereas the majority had antibodies to measles, mumps, and rubella. Despite depressed immunity, serious infections were not documented.

SUPPRESSION OF THE OLIVOCOCHLEAR REFLEX: A NEUROTOXIC ADVERSE EFFECT OF VINCRISTINE

Submitted by Helen Kosmidis

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OBJECTIVE: The purpose of this study was to examine the effects of a known neurotoxic regimen, such as the acute lymphocytic leukemia (ALL) Berlin-Frankfurt-Münster 95 (ALL-BFM-95) protocol, on the function of the medial olivocochlear bundle, which was assessed by recording suppression of the amplitudes of distortion-product otoacoustic emissions (DPOAEs) when white noise was applied simultaneously to the contralateral ear.

METHODS: Our population consisted of 3 groups of children with ALL. A baseline examination was performed before the beginning of therapy. DPOAE-suppression measurements were repeated after 4 weekly doses of vincristine in the first group ($n = 12$), after 8 weekly doses in the second group ($n = 12$), and 3 years after completion of the protocol in the third group ($n = 23$). In the third group, a subgroup of 12 children who were exposed to low-dose gentamicin (<13 days) and another 11 children who were exposed to high gentamicin doses (>23 days) were evaluated.

RESULTS: At baseline examination, all groups presented significant suppression at all frequencies. Efferent mediated DPOAE suppression was still present after 4 sessions of vincristine. However, after 8 vincristine sessions, instead of suppression, an increase of amplitudes was noted at 5 (of 12) frequencies. In the subgroups examined 3 years after ALL-BFM-95, the olivocochlear reflex had recovered.

CONCLUSIONS: Enhancement or no significant suppression of OAEs by contralateral noise indicates a probable vincristine-induced insult to the efferent cochlear innervation. This adverse effect seems to take place early in the course of chemotherapy and is slowly reversed a few years after chemotherapy. The clinical implications of these findings may need additional investigation.

SCREENING NEWBORNS FOR SICKLE CELL DISEASE IN GHANA

Submitted by Kwaku Ohene-Frempong

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INTRODUCTION: Screening of newborns for sickle cell disease (SCD) allows early initiation of prophylactic therapy, parental education, and comprehensive management, which results in reduced mortality. Since April 1993, a demonstration project to develop and implement a program of newborn screening for SCD has been conducted in Kumasi, Ghana, by the Comprehensive Sickle Cell Center at the Children's Hospital of Philadelphia in collaboration with the Ministry of Health and other institutions in Ghana.

OBJECTIVE: Our goal was to assess the program of screening and follow-up of children with SCD in Ghana.

METHODS: Infants are screened at birth or at well-infant visits within days or a few weeks after birth. Mothers are asked to come for results within 4 weeks, and failing that, an extensive tracking system is used to deliver results to the homes of families with infants with possible SCD. Tracking relies solely on information obtained from mothers at the time of screening. The goal is to enroll infants with possible SCD into the sickle cell clinic by 8 weeks of age. Pregnant women, parents with children, and the general public are educated regularly about the screening program. Children with SCD receive comprehensive care through the Sickle Cell Clinic at Komfo Anokye Teaching Hospital (Kumasi, Ghana).

RESULTS: From February 13, 1995 (when newborn testing was started), to December 31, 2005, a total of 202 244 infants were screened through 8 public health institutions and 14 private clinics in Kumasi and 1 private maternity center and 1 public health Center in Tikrom, a nearby, rural community. A total of 3745 (1.9%) infants were identified as having possible SCD with the following hemoglobin phenotypes according to isoelectric focusing: 2047 (1.04%) fetal sickle cell hemoglobin; 1684 (0.83%) fetal SC hemoglobin; and, 14 (0.003%) fetal SA hemoglobin (Table 1).

TABLE 1. Screening and Tracking Results: February 1995 to December 2005

	No.	%
Total No. of infants screened	202 244	100.0
Infants with possible SCD	3745	1.9 (of infants screened)
Under active tracking (newly diagnosed)	(125)	3.3 (of infants with possible SCD; excluded)
Total possible SCD accounted for	3620	96.7 (of infants with possible SCD; reported)
Lost to follow-up/never found	(494)	13.6 (of infants with possible SCD; reported)
Dead before contact made	(34)	0.9 (of infants with possible SCD; reported)
No. contacted with results (eligible for enrollment)	3092	85.4 (of infants with possible SCD; reported)
Came for results	651	21.0 (of those contacted)
Through home visiting	2441	79.0 (of those contacted)
Eligible but not enrolled after contact	477	15.4 (of those eligible)
Enrolled in clinic	2615	84.6 (of those eligible)
Known deaths after enrollment	109	4.2 (of those enrolled)

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