

Final height in survivors of childhood acute leukemia

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Background

Long-term survivors of childhood acute leukemia can suffer from growth impairment. The purpose of this study was to evaluate longitudinal growth and final height of pediatric patients who were treated with acute leukemia and factors that can cause growth impairment.

Methods

Of 234 patients (133 males and 101 females) who were diagnosed as acute lymphoblastic leukemia (ALL; n=162) or acute myeloblastic leukemia (AML; n=72) before age 18 between June 1996 and June 2009 were included. We reviewed height standard deviation scores (SDS) from diagnosis to 5 years after the diagnosis. Final height SDS of 112 patients who reached final height at enrollment and risk factors such as sex, age at diagnosis, diagnosis, pubertal status at diagnosis, radiation and chronic graft-versus-host-disease (cGVHD) that can affect growth were evaluated.

Table 1. Clinical characteristics of total 234 patients treated with childhood acute leukemia and 112 patients who reached their final height (FH).

	Total group	FH group
No.	234	112
Sex		
Male (n)	133 (56.8%)	65 (58.0%)
Female (n)	101 (43.2%)	47 (42.0%)
Diagnosis		
ALL (n)	162 (69.2%)	69 (61.6%)
AML (n)	72 (30.8%)	43 (38.4%)
Treatment		
Chemotherapy only (n)	155 (66.2%)	59 (52.7%)
HSCT (n)	79 (33.8%)	53 (47.3%)
Age at diagnosis (yrs)	6.7 ± 4.3	9.7 ± 3.9
Age at enrollment (yrs)	15.4 ± 4.4	19.2 ± 2.6
Duration of follow-up (yrs)	8.7 ± 2.8	9.3 ± 3.3
Age at menarche for girls (yrs)	12.3 ± 1.7	12.4 ± 1.8

Conclusion

The loss of final height in survivors of childhood acute leukemia was significantly related with younger age at diagnosis.

Results

- The mean height SDS at diagnosis of 234 patients was 0.37 ± 1.05 and at 5 years after the diagnosis was -0.23 ± 1.12 (Fig. 1).
- The mean final height SDS of 112 patients was -0.89 ± 1.31 that was significantly lower than the height SDS at diagnosis (Fig. 2).

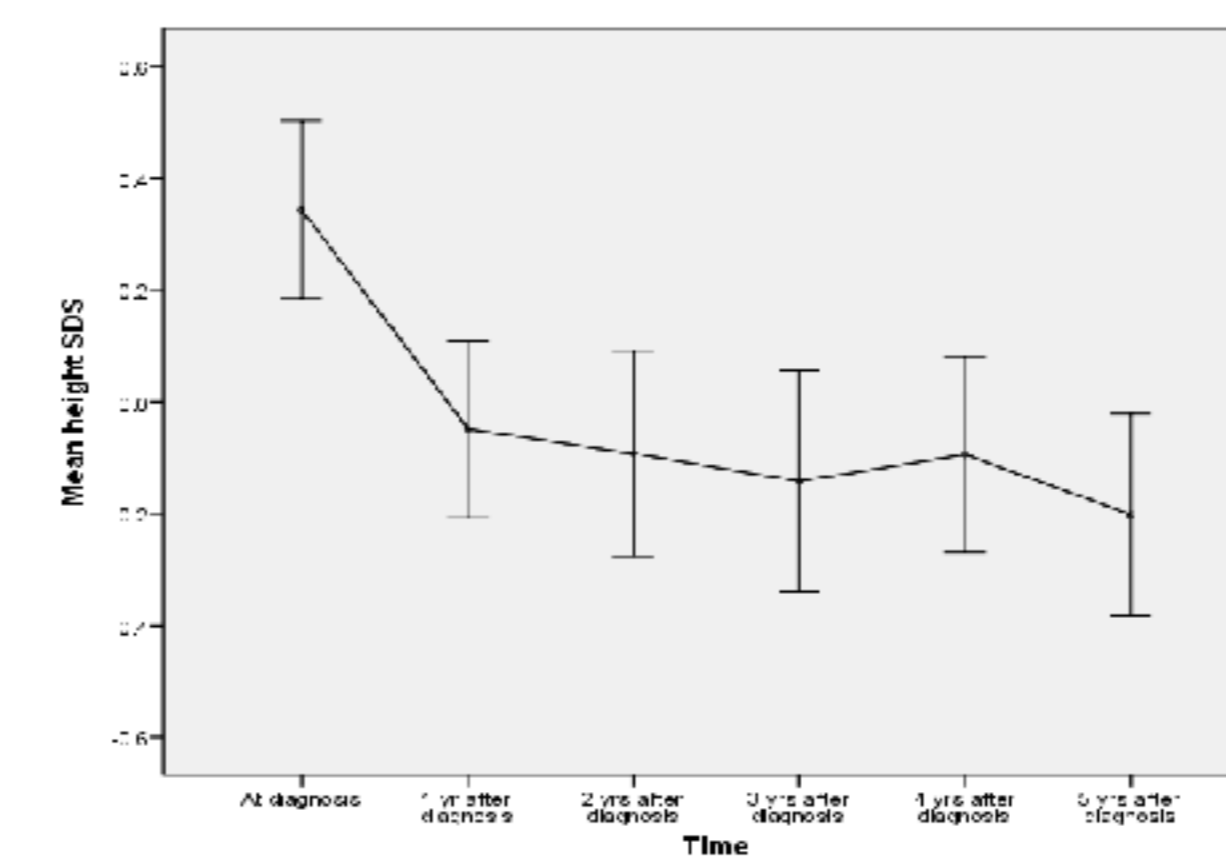


Figure 1. Changes in mean height SDS from diagnosis to 5 years after diagnosis of total 234 patients for treated with acute leukemia.

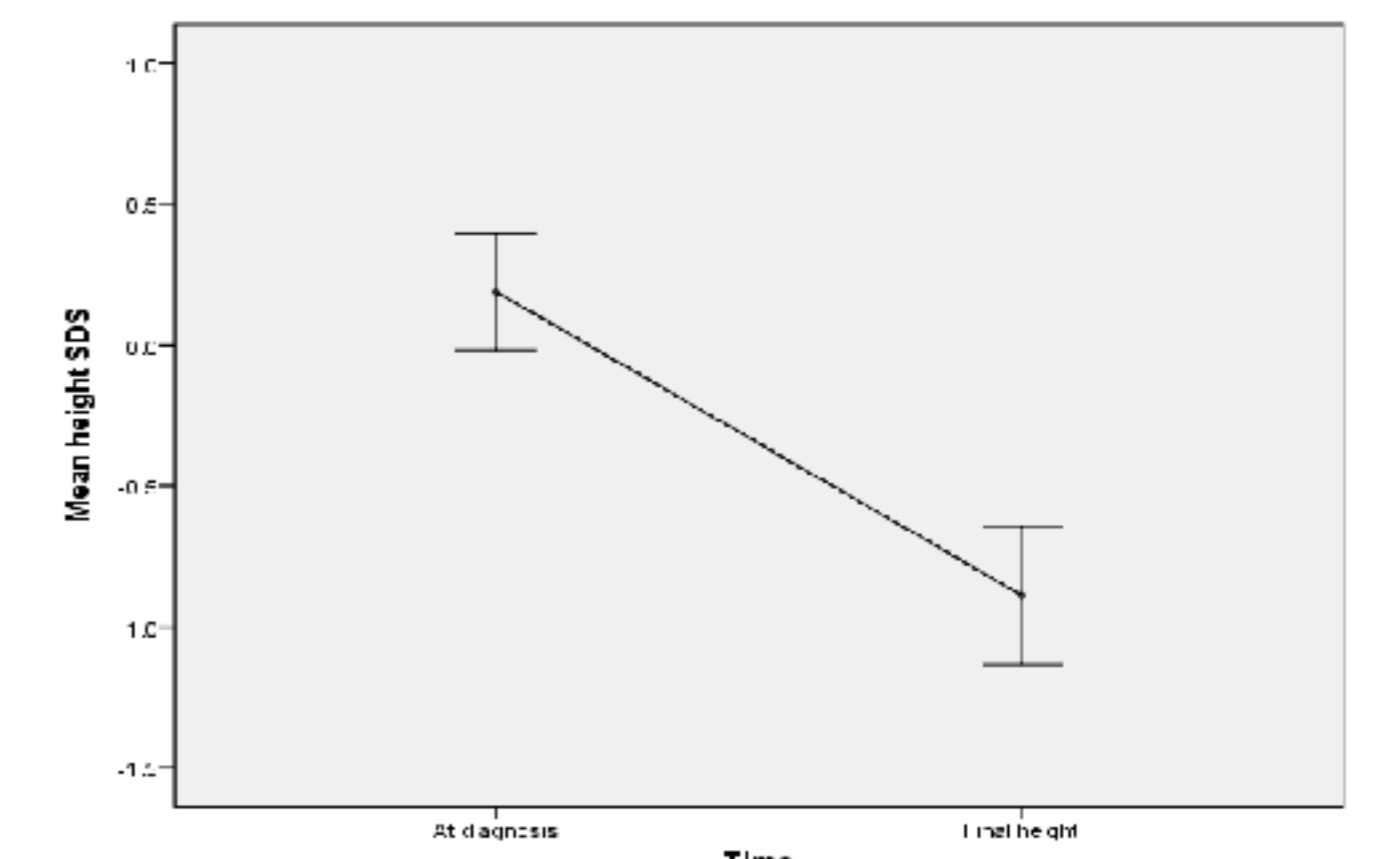


Figure 2. Mean height SDS at diagnosis and final height of the pediatric acute leukemia patients (n=112).

- The height loss was more severe in the patients who received HSCT than the patients who received chemotherapy only (Fig. 3).

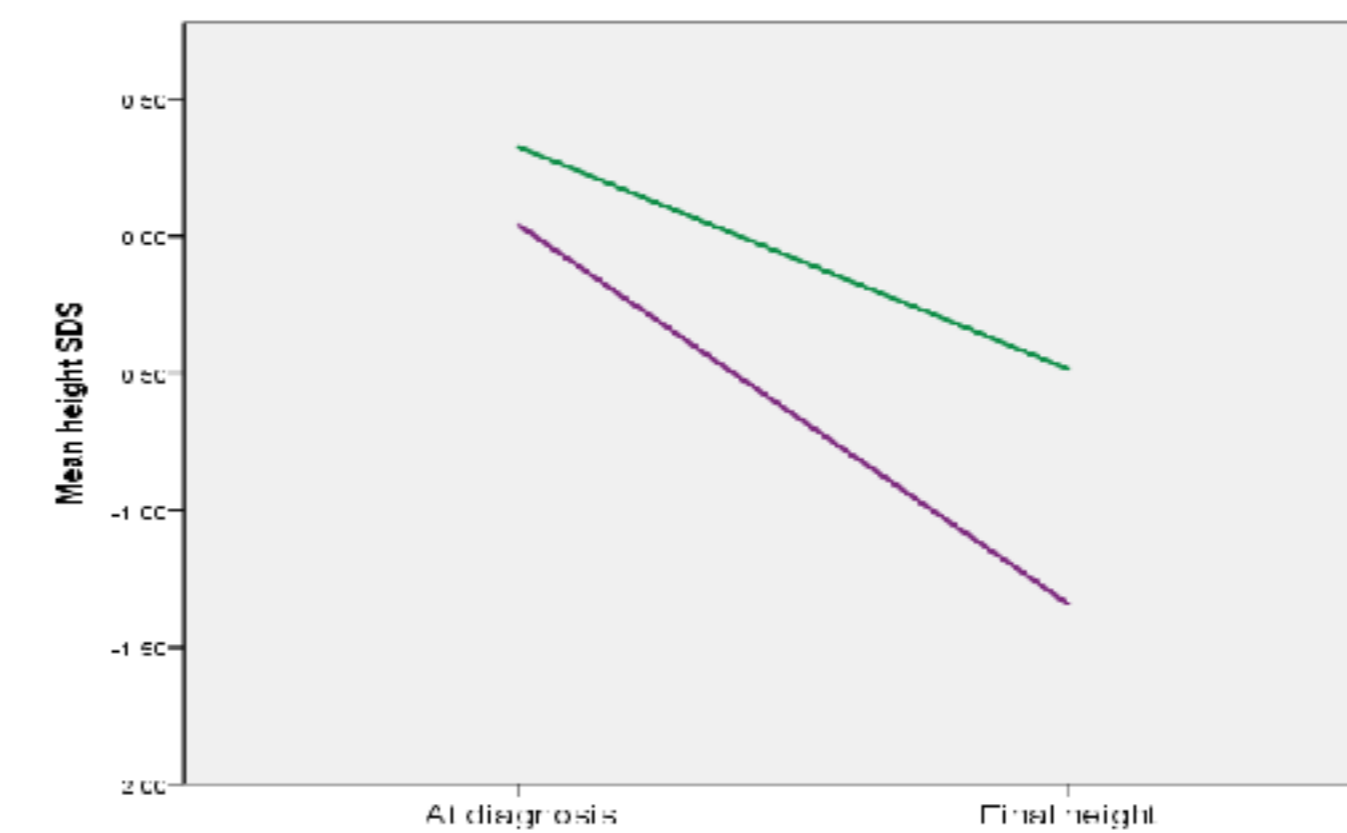


Figure 3. Decreases of final height SDS compared to height SDS at diagnosis were more severe in the patients underwent HSCT than chemotherapy only.

- In multiple regression analysis, younger age at diagnosis was the only significant risk factor of loss in final height in both chemotherapy group and HSCT group ($p=0.008$ and $p=0.002$, respectively).

Table 2. Linear regression analysis to evaluate the risk factors of growth deceleration in the patients treated with chemotherapy only for childhood acute leukemia (n=59).

	Univariate linear regression				Multivariate linear regression*			
	B	SE	β	P-value	B	SE	β	P-value
Sex (Male)	-0.026	0.234	-0.015	0.912				
Diagnosis (ALL)	-0.519	0.287	-0.233	0.075				
Age at diagnosis	0.117	0.031	0.450	<0.001	0.110	0.040	0.424	0.008
Prepubertal state at diagnosis	-0.474	0.224	-0.270	0.039	0.080	0.269	0.046	0.767
CNS irradiation	-0.716	0.305	-0.297	0.022	-0.432	0.301	-0.179	0.157

*Adjusted $R^2=0.430$, $F=10.817$ ($p<0.001$)

Table 3. Linear regression analysis to evaluate the risk factors of growth deceleration in the patients received hematopoietic stem cell transplantation for treatment of acute leukemia (n=53).

	Univariate linear regression				Multivariate linear regression†			
	B	SE	β	P-value	B	SE	β	P-value
Sex (Male)	-0.433	0.355	-0.168	0.228				
Diagnosis (ALL)	-0.927	0.341	-0.356	0.009	-0.010	0.491	-0.004	0.985
Age at diagnosis	0.177	0.034	0.586	<0.001	0.117	0.031	0.450	0.002
Prepubertal state at diagnosis	-1.197	0.351	-0.431	0.001	-0.102	0.407	-0.037	0.804
Conditioning (TBI)	-1.192	0.315	-0.468	<0.001	-0.928	0.486	-0.364	0.062
Chronic GVHD	-0.106	0.396	-0.038	0.789				
Gonadal dysfunction	0.430	0.372	0.160	0.253				
Growth hormone deficiency	-0.537	0.450	-0.165	0.238				

†Adjusted $R^2=0.430$, $F=10.817$ ($p<0.001$)