Original Study

Influence of Insurance and Marital Status on Outcomes of Adolescents and Young Adults With Acute Lymphoblastic Leukemia

Andrew E. Fintel,[1] Omer Jamy,[2] Mike G. Martin[1]

Abstract

Outcomes for adolescents and young adults with acute lymphoblastic leukemia are worse when treated with adult rather than pediatric protocols; one criticism is that this may be due to "emancipation" of young adults. Population based review did not show marital and insurance status to be predictive of medial overall survival while age was.

Background: Although outcomes for adolescents and young adults (AYA) with acute lymphoblastic leukemia (ALL) are worse when treated according to adult rather than pediatric protocols, one criticism is that this may be due to the emancipation of young adults. **Methods:** Using case listing session of Surveillance, Epidemiology, and End Results (SEER) 18 (1973-2010), we examined outcomes for AYA with ALL defined similar to Cancer and Leukemia Group B (CALGB) 10,403 criteria (age 18-30) predicated on marital and insurance status as surrogates for emancipation (limiting analysis to 2007-2010). Analyses were conducted with SEER*Stat 8.1.2, Microsoft Excel 2007, and GraphPad Prism 6. Comparisons were made by the Fisher exact test and log rank test (Mantel-Cox); all *P* values were 2-sided. **Results:** Although age (24 and younger vs. 25 and older) was predictive of median overall survival (OS) (not reached vs. 33; $P = .0029$) (3-year OS 66% vs. 49%), social factors were not. Three-year OS for insured versus uninsured patients was 61% versus 50%, and median OS was not reached versus 30 months ($P = .2334$). Three-year OS for single versus married patients was 62% versus 55%, with median OS not reached for both groups ($P = .1084$). **Conclusion:** Insurance status and marriage did not influence outcomes for AYA with ALL, suggesting that intrinsic differences in disease and disease-specific therapies are more important than social issues.

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Introduction

With over 5000 cases of acute lymphoblastic leukemia (ALL) being diagnosed every year, we have seen an incremental improvement in the long-term survival of these patients.[1,2] The success seen in the pediatric population (0-15 years old) has unfortunately not translated completely to the population aged 15 to 39 years, a population referred to as adolescents and young adults (AYA). Looking at the general population, a steep decline in ALL outcomes is observed while transitioning from the pediatric to the AYA population. A steady decline is observed in the transition from the AYA population to adulthood.[2-4]

ALL is one of the leading causes of cancer-related death in AYA.[1,5] With adult centers catering to teenagers and pediatric practices looking after patients up to 21 years old, treatment options for AYA have been fragmented between adult and pediatric protocols for ALL. Several retrospective studies have been conducted to compare the outcome of ALL in AYA when treated with adult versus pediatric protocol. A significant improvement in survival was shown with the pediatric protocol in all but one study. That study, from Finland, showed that the rates of complete remission and event-free survival were similar in both the adult and the pediatric protocols.[4,6,7]

Recent studies have shed light on the unique cytogenetic and biologic abnormalities of ALL in AYA. ALL in AYA has a higher incidence of the genetic abnormalities, thus carrying a poor prognosis.[2] Features distinctive to the AYA host have also been recognized. The tolerance to treatment regimens differs

[1]Department of Hematology/Oncology, The West Clinic
[2]Department of Internal Medicine
University of Tennessee Health and Science Center, Memphis, TN

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Address for correspondence: Andrew E. Fintel, DO, West Clinic/University of Tennessee Health Science Center, 100 N Humphreys Blvd, Memphis, TN 38120
E-mail contact: afintel@westclinic.com

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Table 1 Patient Characteristics

Characteristic	ALL	Insured	Uninsured	Married	Single
No. of subjects	576	502	73	112	464
Age (years)	22	22	23	27	21
Ethnicity (white/black/other) (%)	86/6/9	85/6/9	84/11/5	92/2/6	83/7/10
Gender (M/F) (%)	64/36	64/36	67/33	63/37	64/36
Median year of therapy	2008	2008	2008	2008	2009
Subtype (%)					
B-cell ALL, NOS	5	4	6	7	5
Burkitt cell	2	2	4	2	2
Precursor-cell lymphoblastic leukemia	80	80	82	81	80
T-cell leukemia/lymphoma	12	13	8	10	13

Abbreviations: ALL = acute lymphoblastic leukemia; NOS = not otherwise specified.

substantially between AYA and children. The pharmacokinetics and pharmacodynamics of various agents changes with the age of the host and translates into higher toxicities and resistance.[5] Poor prognosis in AYA with ALL has also been shown when studies have looked at the social aspect of the disease while controlling for biologic factors.[3,8]

One criticism behind the poor prognosis of ALL in AYA is the emancipation of this particular population. Psychosocial challenges, including insurance barriers, lack of clinical trials, growing independence, and marital status, may also play significant roles in determining the prognosis of ALL in AYA.[8-10]

The aim of our study was to look at a large and diverse population in terms of ethnicity, sex, and disease subtype, and assess the impact of marital status and insurance status on the prognosis of ALL in AYA.

Materials and Methods

We used the Surveillance, Epidemiology, and End Results (SEER) 18 database (1973-2010) in a case-listing session of SEER*Stat 8.15 to analyze the outcomes for AYA with ALL defined similar to Cancer and Leukemia Group B (CALGB) 10,403 (18-30) criteria predicated on marital and insurance status as surrogates of emancipation (limiting analysis to 2007-2010).

SEER cancer registries collect data from the states of Connecticut, Iowa, Utah, New Mexico, Hawaii, and the metropolitan areas of Detroit and San Francisco—Oakland. Ten predominantly black counties from rural Georgia were added in 1978. Other samples include American Indians residing in Arizona and native Alaskans. Los Angeles and San Jose were added in 1992 to include minority populations, especially Hispanics.

Table 2 OS by Age for Adolescents and Young Adults With ALL

Age	Median OS (months)[a]
≤24 years	NR
≥25 years	33

Abbreviations: ALL = acute lymphoblastic leukemia; NR = not reached; OS = overall survival.
[a] $P = .0029$.

The SEER database classifies cancer histology and topography information on the basis of the third edition of the International Classification of Diseases for Oncology (ICD-O-3). Cases for ALL were located by primary site codes (C000-C809) and histology codes (9826, 9835-9837).

Analyses were conducted with SEER*Stat 8.1.2, Microsoft Excel 2007, and GraphPad Prism 6. Comparisons were made by the Fisher exact test and the log rank test (Mantel-Cox); all *P* values were 2 sided.

Results

Five hundred seventy-four patients aged 18 to 30 years were identified in the SEER database. The average age at the time of diagnosis was 22 years (range, 18-30 years). Eighty-five percent were white, and 64% were men. The median year of diagnosis was 2008. Among these patients, 503 (87%) were insured and 73 (13%) were uninsured. The median age at diagnosis for insured and uninsured subjects was 22 and 23, respectively. One hundred twelve patients (19%) were married, and the median age at diagnosis was 27 years. Four hundred sixty-four patients (81%) were single, and their average age at diagnosis was 22 years. Among the different subtypes of ALL, we identified 80% as being precursor-cell lymphoblastic leukemia, 12% as being T-cell leukemia/lymphoma, 5% being B-cell ALL not otherwise specified, and 2% being Burkitt-cell leukemia. Age, ethnicity, sex, median year of diagnosis, and

Figure 1 Age and OS for AYA With ALL