

Chronic lymphocytic leukemia radiogenicity: a systematic review

Sharon R. Silver · Shannon L. Hiratzka ·
Mary K. Schubauer-Berigan · Robert D. Daniels

Received: 3 July 2006 / Accepted: 19 July 2007 / Published online: 13 August 2007
© Springer Science + Business Media B.V. 2007

Abstract

Objective Chronic lymphocytic leukemia (CLL) is generally considered to be non-radiogenic and is excluded from several programs that compensate workers for illnesses resulting from occupational exposures. Questions about whether this exclusion is justified prompted a Congressional mandate to the National Institute for Occupational Safety and Health (NIOSH) to, further, examine the radiogenicity of CLL. This study revisits the question of CLL radiogenicity by examining epidemiologic evidence from occupationally and medically-exposed populations.

Methods A systematic review of radiation-exposed cohorts was conducted to investigate the association between radiation and CLL. Exploratory power calculations for a pooled occupational study were performed to examine the feasibility of assessing CLL radiogenicity epidemiologically.

Results There is a bias against reporting CLL results, because of the disease's presumed non-radiogenicity. In medical cohort studies that provide risk estimates for CLL, risk is elevated, though non-significantly, in almost all studies with more than 15 years average follow-up. The results of occupational studies are less consistent.

Conclusions Studies with adequate follow-up time and power are needed to better understand CLL radiogenicity. Power analyses show that a pooled study might detect risk

on the order of radiation induced non-CLL leukemia, but is unlikely to detect smaller risks.

Keywords Chronic lymphocytic leukemia · Ionizing radiation · Radiogenicity

Introduction

The etiology of chronic lymphocytic leukemia (CLL) is largely unknown. Studies have demonstrated the involvement of immune system components and genetic abnormalities in the pathogenesis of CLL [1, 2]. Observation of trisomy 12, abnormalities in chromosome 13q14 [3], familial clustering [4], and the phenomenon of anticipation [5] in CLL patients suggest the involvement of multiple genetic pathways.

The role of environmental exposures, such as ionizing radiation and chemicals, in CLL etiology is unclear. Several studies have noted elevations of CLL among farmers [6–8], suggesting increased CLL risk due to exposure to herbicides or pesticides [9]. Exposure to ionizing radiation has also been examined as a potential risk factor for CLL. Since no increases in CLL were observed among the Life Span Study cohort of atomic bomb survivors [10] or among large cohorts treated therapeutically with radiation [11–13], the disease is generally considered non-radiogenic [14].

The US Energy Employees Occupational Illness Compensation Act (EEOICPA) considers CLL non-radiogenic; in fact, CLL is the only cancer assigned a causation probability of zero under EEOICPA [15]. The decision to exclude CLL from compensation stemmed from a lack of evidence for CLL radiogenicity in medically exposed cohorts and in large occupational studies. CLL is also excluded from other compensation programs, including the

S. R. Silver (✉) · M. K. Schubauer-Berigan · R. D. Daniels
Division of Surveillance, Hazard Evaluations, and Field Studies
(DSHEFS), National Institute for Occupational Safety and
Health (NIOSH), 5555 Ridge, Cincinnati, OH, USA
e-mail: ssilver@cdc.gov

S. L. Hiratzka
Constella Group LLC, Durham, NC, USA