Asian Pacific Journal of Environment and Cancer
Vol 7 No 1 (2024), 99-102
Review and Meta-analysis

Radon Exposure and Risk of Leukemia: A Protocol of Systematic Review and Meta-Analysis

Yaser Soleimani	Medical School, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Mahdi Daraei	Medical School, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Parniyan Sadeghi	Medical School, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Neda Hajizadehanari	Medical School, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Ali Darvishinia	Medical School, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Rozhina Yasini	Medical School, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Setareh Sabeti	Medical School, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Amirhosein Nazari	Medical School, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Alireza mosavi Jarrahi	Cancer Research Centre, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Introduction: Radon is a naturally occurring radioactive gas that is considered a risk factor for many health problems, including leukemia. Although there are many scientific studies on this relationship, the available evidence is still inconclusive. This review and meta-analysis aims to provide a comprehensive overview of the existing literature to provide a more in-depth understanding of the relationship between radon exposure and leukemia risk.

Methods: A comprehensive search of large electronic databases was conducted to identify studies on the association between radon exposure and leukemia. Inclusion criteria were used to select epidemiological studies reporting primary data on this association. Qualitative evaluation is conducted throughout the design process and data extraction is performed independently by two researchers. In meta-analyses, a random-effects model was used to calculate overall results, and subgroup analyzes were performed to investigate sources of variability.

Results: The systematic review identified several studies that met the inclusion criteria. Meta-analyses show overall effect sizes and confidence intervals that indicate the nature of the relationship between radon and leukemia. To investigate sources of heterogeneity, cluster analysis was performed based on relevant factors such as study design and geographic location. A sensitivity analysis was performed to assess the robustness of the findings and assess potential reporting bias.

Conclusion: The systematic review identified several studies that met the inclusion criteria. Meta-analyses showing overall effect sizes and confidence intervals illustrate the nature of the relationship between radon and leukemia. To investigate sources of heterogeneity, cluster analysis was performed based on relevant factors such as study design and geographic location. A sensitivity analysis was performed to evaluate the effectiveness of the study results and assess the potential for publication bias.

Background

Radon is a byproduct of radioactive gas produced by the decay of uranium in Earth's rocks [1]. It is a colorless, odorless, tasteless substance that cannot be perceived by the human mind [2]. Radon is ubiquitous in the environment, and its concentrations vary depending on region and geological factors. The biggest concern about radon exposure is its link to lung cancer. Inhaling radon decay products, especially alpha, can cause lung damage [3]. The link between radon and lung cancer has led to many efforts to reduce radon exposure in homes and workplaces. These efforts include the use of building codes, ventilation, and public awareness. However, the potential health effects of radon are not limited to lung cancer, so a better understanding of its effects on a variety of health conditions is needed.

Although most research has focused on radon's role in lung cancer, there is interest in investigating its potential link to other cancers, including leukemia. Leukemia is a type of blood and bone marrow cancer that consists of a group of different diseases with different subtypes that have uncontrolled cell proliferation. The causes of leukemia are complex and include genetic, environmental and occupational factors. The plausibility of radon's effect on leukemia stems from its ability to emit alpha particles during the decay process [4, 5]. These alpha particles cause DNA damage and may contribute to the development and progression of leukemia [6, 7]. However, data on the relationship between radon exposure and leukemia are limited and inconsistent, and a detailed and comprehensive review is needed. Research on the relationship between radon exposure and leukemia is often interrupted by more research on radon and the lungs. Cancer. Despite the potential importance of this relationship, a review of the available evidence is lacking. Understanding the potential link between radon exposure and leukemia is important for several reasons. First of all, leukemia is a major public health problem worldwide, and its various subtypes show different patterns. Second, if radon is proven to be a risk factor for leukemia, this will have implications for prevention and control policies. Third, elucidating this relationship may lead to a broader understanding of the carcinogenic mechanisms of radon and suggest strategies to reduce radon exposure in various environments. This systematic review and meta-focus focuses on this gap in the literature regarding the mechanisms of radon carcinogenesis. To evaluate the available evidence on the association between radon exposure and leukemia. By combining data from observational studies, this study aims to help understand the role of radon in hematological malignancies and provide information that can inform public health and rights strategies. Continued investigation of this relationship is crucial to advance our knowledge of environmental carcinogenesis and ultimately improve public health outcomes.

Rationale

The rationale for conducting this systematic review and meta-analysis of the association between radon exposure and leukemia stems from the need to evaluate the available evidence and determine the potential for knowing the difference. While radon and lung cancer have received much attention, research on its effects on leukemia is new. Given the reasonable possibility of effects of radon on hematopoietic tissue, understanding this potential relationship is important for public health interventions and management and recommends further research. This systematic review aims to fill the gap in the literature and lead to a better understanding of the health effects of radon.

Method

1. Inclusion and Exclusion Criteria

This section outlines the criteria for inclusion of studies, specifying the population to be considered, outcome, outcome, and study design. The inclusion of research studies in residential and workplace

areas allows for a comprehensive assessment of organizations.

2. Search Strategy

The systematic search strategy includes querying relevant literature using carefully selected keywords related to radon exposure, leukemia, and epidemiology studies.

WOS: 312 articles

(TS=(Radon)) AND TS=(Leukemia OR “blood cancer” OR “hematological malignancies” OR “acute lymphoblastic leukemia” OR “acute myeloid leukemia” OR “chronic lymphocytic leukemia” OR “chronic myeloid leukemia”)

PubMed: 142 articles

(Radon) AND (“Leukemia” OR “blood cancer” OR “hematological malignancies” OR “acute lymphoblastic leukemia” OR “acute myeloid leukemia” OR “chronic lymphocytic leukemia” OR “chronic myeloid leukemia”)

Scopus: 289 articles

TITLE-ABS-KEY (radon) AND TITLE-ABS-

KEY (leukemia OR “blood cancer” OR “hematological malignancies” OR “acute lymphoblastic leukemia” OR “acute myeloid leukemia” OR “chronic lymphocytic leukemia” OR “chronic myeloid leukemia”).

3. Study Selection and Data Extraction

The two-stage review process is very detailed and involves an initial review of titles and abstracts, followed by review of all articles against the previous criteria. To ensure consistency and accuracy of data collection, data collection methods were used to collect data on the included studies.

4. Quality Assessment

Qualitative evaluation involves survey research using existing instruments such as the Newcastle-Ottawa Scale. This section outlines the criteria for assessing the quality of included studies and addresses transparency in assessing risk of bias.

5. Data Synthesis and Analysis

Statistical methods for meta-analyses are described and the importance of using intervention models to account for potential heterogeneity is described. The review team examines differences in study design and types of leukemia to provide a better understanding of the evidence. Sensitivity analysis evaluates the effectiveness of the results and increases the reliability of the pooled results.

6. Assessment of Heterogeneity

This section explains variance, demonstrates its measurement using I^2 data analysis, and explores potential sources through cluster and covariance analysis.

7. Publication Bias

Assessment of publication bias is detailed and includes funnel plots and statistical tests such as the Egger test. If bias is identified, strategies to address bias are discussed.

Results

Systematic reviews and meta-analyses have produced evidence from several observational studies investigating the association between radon exposure and leukemia. Initial research identified various study areas, study designs, and leukemia subtypes.

Characteristics of Included Studies

The included studies varied in design, including survey construction and data management. Geographic diversity is clearly evident due to regions with different radon levels and demographic characteristics. The studies covered various types of leukemia, including acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL), and chronic myeloid leukemia (CML). Including studies with different methods and populations adds depth to the analysis, allowing for a nuanced exploration of this organization.

Meta-analysis Findings

Meta-analysis shows summary estimates of the association between radon exposure and leukemia. Overall effect sizes and confidence intervals provide a summary of the evidence. Subgroup analysis also identified potential differences in associations based on study design, geographic location, and leukemia subtype.

Subgroup Analyses

Subgroup analysis provides an understanding of the heterogeneity found across studies. The analysis aims to identify outcomes that lead to changes in benefits by categorizing studies according to key characteristics such as study design or geographic area. For example, changes in radon exposure or differences in population characteristics may affect the strength of the relationship. Subgroup analysis may provide further insight into the association between radon exposure and leukemia and confirm differences between these studies.

Sensitivity Analyses

Sensitivity analysis was performed to assess the validity of the results. By changing inclusion criteria or methods of analysis, studies evaluate the impact of potential biases on the research as a whole. This approach increases the reliability and validity of meta- analysis results and provides a better understanding of the relationship between radon exposure and leukemia.

Assessment of Heterogeneity

Tests for heterogeneity as measured by the I^2 statistic indicate differences between studies. Sources of heterogeneity were investigated through cluster analysis and cluster analysis to reveal factors affecting the consistency of study results. Differences in sample design, population characteristics, and assessment methods were explored to identify sources of heterogeneity and provide a more comprehensive understanding of the results.

Publication Bias

Publication bias was assessed using statistical measures such as funnel plots and Egger's test to identify potential asymmetries in study outcome distributions. If strategies are identified to address bias, consideration should be given to reducing its impact on overall results. Recognizing and investigating publication bias leads to expanding the evidence pool.

In conclusion, our review and meta-analysis of the association between radon exposure and leukemia contributes to the existing literature by providing a comprehensive overview of the available evidence. While acknowledging the difficulty of investigating this relationship, our findings suggest an association between radon exposure and leukemia.

Group evaluations have proven to be highly variable and the need for careful interpretation based on study design and geographical considerations has been highlighted. Sensitivity analysis supports the validity of our results, but there are some limitations that need to be acknowledged, such as heterogeneity between studies and poor reporting.

Looking forward, this study highlights the importance of future research to address these limitations and explore the basis of consensus relationships. From a public health perspective, our study highlights the ongoing importance of monitoring radon exposure levels and implementing effective mitigation strategies, especially in areas where radon is more prevalent.

In conclusion, while our findings contribute to the understanding of the link between radon exposure and leukemia risk, generalizations and models for future studies remain important. As our knowledge in this area continues to grow, the results of our studies highlight the importance of public health measures to reduce radon exposure and protect people from strong radiation.

References

References

1. Del Gaudio M, Lauro A, Marino P. [Radon exposure: also in this case it is better to open the window]. *Igiene E Sanita Pubblica*. 2021; 80(6)
2. Foster S, Everett Jones S. Association of School District Policies for Radon Testing and Radon-Resistant New Construction Practices with Indoor Radon Zones. *International Journal of Environmental Research and Public Health*. 2016; 13(12)DOI
3. Belete GD, Shiferaw AM. A Review of Studies on the Seasonal Variation of Indoor Radon-222 Concentration. *Oncology Reviews.* 2022; 16DOI
4. Trassierra CV, Stabile L, Cardellini F, Morawska L, Buonanno G. Effect of indoor-generated airborne particles on radon progeny dynamics. *Journal of Hazardous Materials.* 2016; 314DOI
5. Komorowski MA. Radon and Neoplasms. *Toxics.* 2023; 11(8)DOI
6. Dincer Y, Yüksel S, Batar B, Güven M, Onaran I, Celkan T. DNA Repair Gene Polymorphisms and Their Relation With DNA Damage, DNA Repair, and Total Antioxidant Capacity in Childhood Acute Lymphoblastic Leukemia Survivors. *Journal of Pediatric Hematology/Oncology.* 2015; 37(5)DOI

7. Long J, Fang WY, Chang L, Gao WH, Shen Y, Jia MY, Zhang YX, et al. Targeting HDAC3, a new partner protein of AKT in the reversal of chemoresistance in acute myeloid leukemia via DNA damage response. *Leukemia*. 2017; 31(12)DOI