

Methyl Isocyanate Exposure and Atypical Lymphocytes

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December 3, 1984 marks one of the deadliest chemical disasters of the world took place in Bhopal. The disaster took a toll of 3600 human lives and scores of pets almost instantly. Additional 200 000 people were exposed to the killer gas—methyl isocyanate and its intermediates—to varying degrees.¹ Almost 27 years have gone by since occurrence of this tragic event, the health status of the affected population has not been studied satisfactorily. Both of the exposed survivors and their offspring continue to suffer from the yet-unknown long-term effects. Therefore, the Indian Council of Medical Research (ICMR) has planned to investigate the cases systematically.²

We have been working on the exposed population for the last seven years for cancer risks. We have reported chromosomal instability³ and increased morbidity, especially due to high prevalence of breast cancer in the females and lung cancer in the males among the affected people.⁴ However, the precise role of methyl isocyanate in cancer etiology is yet unclear.⁵ The clinical, epidemiological and *in vitro* investigations do not fully conform to the conclusions of *in vivo* animal studies.^{5,6}

During the cytogenetic monitoring, our attention was captivated by a high prevalence of atypical lymphocytes in the peripheral blood of methyl isocyanate-affected parents and their offspring born post-exposure. Atypical lymphocytes are often observed in the peripheral blood

of the healthy as well as the diseased individuals, albeit at varying proportions. On the average, 7.5% of the mononuclear cells are atypical lymphocytes in the healthy individuals; it occurs due to exogenous antigens including viral infections, drug hypersensitivity and toxic reactions. Atypical lymphocytes also occur following post-perfusion, immunizations, radiation exposure, hormonal disruption, autoimmune diseases, idiopathic disorders, Hodgkin's lymphoma and graft rejection.^{7,8}

Atypical lymphocytes appear in the peripheral blood in the course of many pathological conditions. However, its relationship with the environmental chemicals is not clearly well understood. The reports in this connection are scanty in the literature. A significantly high incidence of peripheral blood atypical lymphocytes was observed in the residents exposed to uranium, arsenic and fluoride through drinking water in Pofadder area of North Western Cape, South Africa.⁹ Another study pertains to the exposure of certain Iranian people to sulfur mustard during chemical invasion of Iraq in Iran-Iraq war, which highlighted increased incidence of atypical lymphocytes in peripheral blood of the victims.¹⁰

For the first time, we observed high percentage of atypical lymphocytes in the peripheral blood of people exposed to methyl isocyanate. For example, mother, father and the daughter of a family had

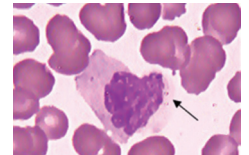
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17%, 13%, and 21% atypical lymphocytes, respectively. Although, these people were neither found suffering from any chronic diseases nor had received any medications for the last several months, they had high counts of atypical lymphocytes. The precise reason for this is yet to be ascertained, but we feel inclined to suggest that prior exposure to methyl isocyanate might be getting manifested as increase in the frequency of atypical lymphocytes.

Methyl isocyanate is used in the production of carbamate pesticides, rubbers and adhesives. More studies are needed to substantiate the probable association between exposure to methyl isocyanate and atypical lymphocytosis. There is an urgent need to monitor hematopoietic disorders among people (especially workers) exposed to methyl isocyanate for a long time.

Conflicts of Interest: None declared.

References

1. Dhara VR, Kriebel D. The Bhopal Gas Disaster: It's Not Too Late for Sound Epidemiology. *Arch Environ Health* 1993;**48**:436-7.
2. Indian Council of Medical Research. Call for Research Proposals on the long term effect(s) of MIC gas, if any, on the Bhopal Population either exposed or affected (in December 1984) 2010. Available from <http://icmr.nic.in> (Accessed October 16, 2011).
3. Malla TM, Senthilkumar CS, Sharma NC, Ganesh N. Chromosome instability among Bhopal gas tragedy survivors. *Am Eur J Toxicol Sci* 2011;**3**:245-9.
4. Senthilkumar CS, Tahir M, Sah NK, Ganesh N. Cancer Morbidity among Methyl Isocyanate Exposed Long-Term Survivors and their Offspring: A Hospital-Based Five Year Descriptive Study (2006 - 2011) and Future Directions to Predict Cancer Risk in the Affected Population. *Asian Pac J Cancer Prev* 2011;**12**:3443-52.
5. Senthilkumar CS, Sah NK, Ganesh N. Methyl Isocyanate and Carcinogenesis: Bridgeable Gaps in Scientific Knowledge. *Asian Pac J Cancer Prev* 2012;**13**:2429-35.
6. Senthilkumar CS. Bhopal Methyl Isocyanate Affected Population and Cancer Susceptibility: Where Do We Stand Now? *Asian Pacific J Cancer Prev* 2012;**13**:5323-4.
7. Shiftan TA, Mendelsohn J. The circulating Atypical Lymphocyte. *Hum Pathol* 1978;**9**:51-61.
8. Wood TA, Frenkel EP. The atypical lymphocyte. *Am J Med* 1967;**42**:923-36.
9. Toens PD, Stadler W, Wullschlege NJ. The Association of Groundwater Chemistry and Geology with Atypical Lymphocytes (as Biological Indicator) in the Pofadder Area, North Western Cape, South Africa. In: WRC Report No. 839/1/98, Water Research Commission, Pretoria, South Africa, **1998**, pp 144.
10. Hassan ZM, Ebtakar M, Ghanei M, *et al*. Immunobiological Consequences of Sulfur Mustard Contamination. *Iran J Allergy Asthma Immunol* 2006;**5**:101-8.

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