RESEARCH COMMUNICATION

Classification of Risk Occupation for Benzene Exposure by Urine Trans, Trans - munconic Acid Level

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Abstract

Leukemogenesis due to benzene exposure is of particular concern because of ongoing exposure to thousands of workers in industrial plants. Monitoring of at-risk workers is recommended and of several biomarkers, urine trans,trans - muconic acid (ttMA) determination is a helpful test. The aim of this work was to classify risk occupation for benzene exposure by urine ttMA level. Here, the author compared exposure risk ratios from 6 previous reports concerning urine ttMA determination. Of interest, the high risk occupations were found to be those which have direct contact with benzene in environmental ambient air, with petroleum fuel as the common source.

Key Words: Benzene - ttMA - risk - occupation

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Introduction

Benzene is a colorless poisonous liquid with a sweet - odor (Agency for Toxic Substances and Disease Registry (ATSDR), 1997). Breathing extremely high levels can result in death while major exposure can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Long-term benzene exposure is hematotoxic, genotoxic, genetoxic and immunotoxic. Although the mechanisms underlying benzene-induced toxicity and leukemogenicity are not yet fully understood, they are likely to be complicated by various pathways, especially those of metabolism and programmed cell death (Yoon et al., 2003).

At present, work with benzene is subject to the Control of Substances Hazardous to Health (COSHH) Regulations 1999 because of ongoing exposure to thousands of workers in the industrial plants. Monitoring for benzene exposure among the at-risk workers is recommended and of several biomarkers, urine trans,trans - muconic acid (ttMA) determination is a helpful (Biro et al., 2002; Wiwanitkit, 2004). There have been several reports on the level of urine ttMA among occupations, however, there has been no comparison. The aim of this work is to classify risk occupation for benzene exposure by urine ttMA level.

Materials and Methods

Primary Data

This study was designed as a descriptive retrospective study. A literature review of papers concerning urine ttMA levels was performed using works cited in the Index Medicus and Science Citation Index using the key word "urine trans, trans, muconic acid". The reports that did not relate to using urine ttMA for monitoring of risk occupation or lacked English text or contained no complete data, lack for controls, were excluded from further analysis.

Statistical Analysis

Descriptive statistics were used. For each report, the mean levels of urine ttMA in high risk subjects and controls were extracted and exposure risk ratios were calculated. Since there might be differences in the laboratory setting, analysis and environment, risk classification by ratio may be most appropriate. The derived ratios from all reports were collected and divided into two groups based on statistical ranking: low risk (lower than the median), and high risk (equal to or higher than median). All the statistical analyses in this study were made using SPSS 7.0 for Windows Program.

Results

According to the search there are 100 reports on urine ttMA. Of these, 6 (Wiwanitkit et al., 2003a; de Paula et al., 2003; Wiwanitkit et al., 2003b; Thummachinda et al., 2002; Wiwanitkit et al., 2001a; Suwansaksri et al., 2000) were recruited for the present study. The exposure risk ratios are presented in Table 1, being ranked from 2.3 to 33.3, with amedian equal to 12.4. According to our study, the classification of risk occupation for benzene exposure by urine ttMA level is presented in Table 2.

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Table 1. The Exposure Risk Ratio in Previous Studies Concerning Urine ttMA Determination in Risk Occupations

Reports	Occupation	Mean urine ttMA level (mg/gCreatinine)		Exposure risk ratio
		Risk subjects	Controls	
Wiwanitkit et al., (2003a)	Traffic policeman	0.79	0.05	15.8
de Paula et al., (2003)	Oil refinery worker	0.19	0.01	19.0
Wiwanitkit et al (2003b)	Press worker	0.56	0.08	7.0
Thummachinda et al., (2002)	Fishermen	0.18	0.02	9.0
Wiwanitkit et al., (2001a)	Gas station attendants	4.00	0.12	33.3
Suwansaksri et al., (2000)	Mechanics	0.28	0.12	2.3

Table 2. The Classification of Risk Occupation for Benzene Exposure by Urine ttMA Level

Classification	Occupations
High risk	Press worker, fisherman, mechanics
Low risk	Policeman, oil refinery work, gas station attendant

Discussion

Benzene, an established human leukemogen (Yoon et al., 2003; Wiwanitkit, 2004) is a common toxic volatile substance, found in many industrial processes (Chocheo, 2000). International organizations such as Agency for Toxic Substances and Disease Registry (ATSDR) (Agency for Toxic Substances and Disease Registry (ATSDR), 1997) have documented benzene toxicity and recommend monitoring of benzene exposure for groups at risk.

Several occupations can be mentioned in this regard. Urine ttMA, a novel biomarker, is mentioned as an effective tool in monitoring of exposure to benzene with low interference (Wiwanitkit, 2004; Wiwanitkit et al., 2001b) with a close correlation regarding hematological aberrations (Wiwanitkit et al., 2004). From the six reports on the high level of ttMA among many occupational workers (Wiwanitkit et al., 2003a; de Paula et al., 2003; Wiwanitkit et al., 2003b; Thummachinda et al., 2002; Wiwanitkit et al., 2001a; Suwansaksri et al., 2000), we conclude that the high risk occupations are those which have to direct contact with benzene in environmental ambient air and the common source is petroleum fuel. For further application, cutoff median of exposure risk ratio of 12.4 may be a useful value for determining whether investigated workers are at high risk in future studies.

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