

Micronucleus: a cellular damage marker caused by chronic benzene exposure

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INTRODUCTION AND OBJECTIVES

Micronucleus is so called for its shape assembling the cellular nuclei, and for its composition, a mutated part of the chromosome that suffered damage in the moment of the mitosis, due to exposure to any genotoxic substance.

Benzene is an aromatic hydrocarbon derived from petroleum or coal, and is present in the gasoline mixture. With six carbon and hydrogen atoms, previously known as a cancerigen product, in close contact to the human it is transformed into benzene oxid and than in S-phenilmercaptapurin acid or trans-trans-muconic acid in the liver or lungs.

The aim of this work was to analyze micronucleus in blood smear from gas station attendants as a biomarker associated to the chronic exposure to benzene and smoke.

MATERIAL AND METHOD

Six-three gas station workers and 52 controls, both genders, more than 18 years old were recruited between 2014 and 2016, in the city of Rio de Janeiro, Table 1. Both invited to sign in informed consent. Criteria for recruiting the controls included good health and never being occupationally exposed to benzene. Data on tobacco consumption was collected in a questionnaire where they made a self-declaration, Table 2. Blood smears for each subject were done and stained by May Grünwald Giensa. The red blood cells examined at a magnification of 1,000X, one thousand red blood cells per slide to determine micronuclei's frequency. Micronucleus must have a round shape and be unique in erythrocyte. Comparisons between the number of micronuclei in groups were achieved by the Mann-Whitney test. The results were analyzed by the software PSAW, version 18. Q-square test with p-values <0.05 were considered significant.

RESULTS AND CONCLUSIONS

The absolute number of micronuclei was 32 in the gas-station workers group and 15 micronuclei in the control group. Assessment of the micronuclei frequencies showed a significant difference between exposed workers and controls, but the influence of tobacco consumption was not significant between the two groups. Therefore, our results proved that tobacco consumption did not influence the increase of the frequency of micronuclei observed in red blood cells in the workers group.

Table 1 – Workers and Controls Demographic data

Group	Women	Men	Mean Age (range)
Gas station workers (N=63)	48	15	37 (18-63years)
Control (N=52)	41	11	30 (19-68 years)

Micronuclei are small remnants that have the color of pyknotic nucleous on May-Grünwald Giemsa stain and generate a positive Feulgen reaction for DNA (Figures 1 and 2). They are round, no larger than 0.5um in diameter. In pathologic situations, they appear to represent chromosomes that have separated from the mitotic spindle during abnormal mitosis and contain a high proportion of centromere material along with heterochromatin. To our knowledge, this is the first time the frequency of micronuclei is analyzed by optical microscopy in human red blood cells.

Table 2 – Data on tobacco consumption

Group	Smoker	Non smoker	Former smoker	No information
Gas station workers(N =63)	7	44	9	3
Control (N = 52)	7	39	6	0

Figure 1

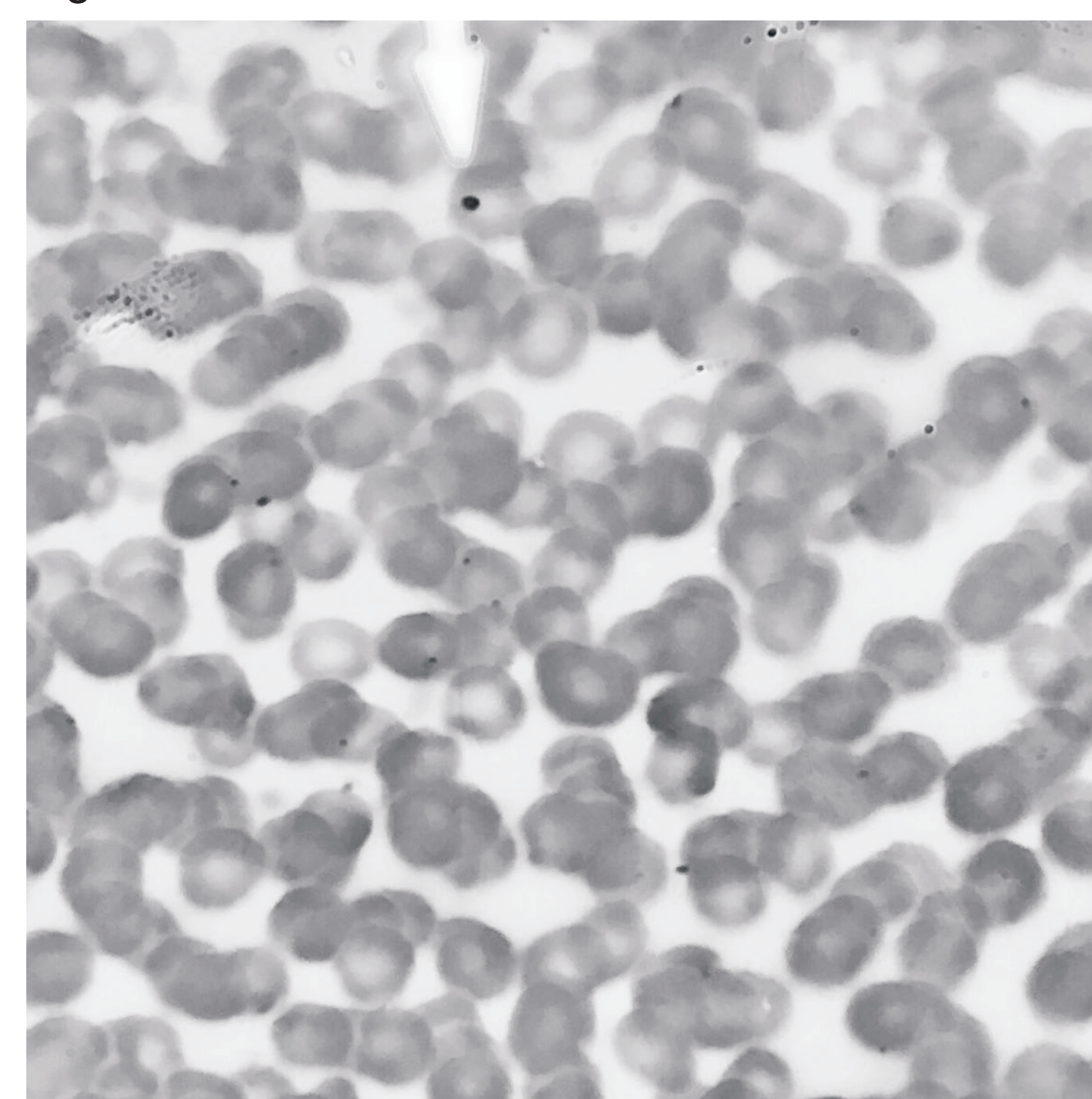
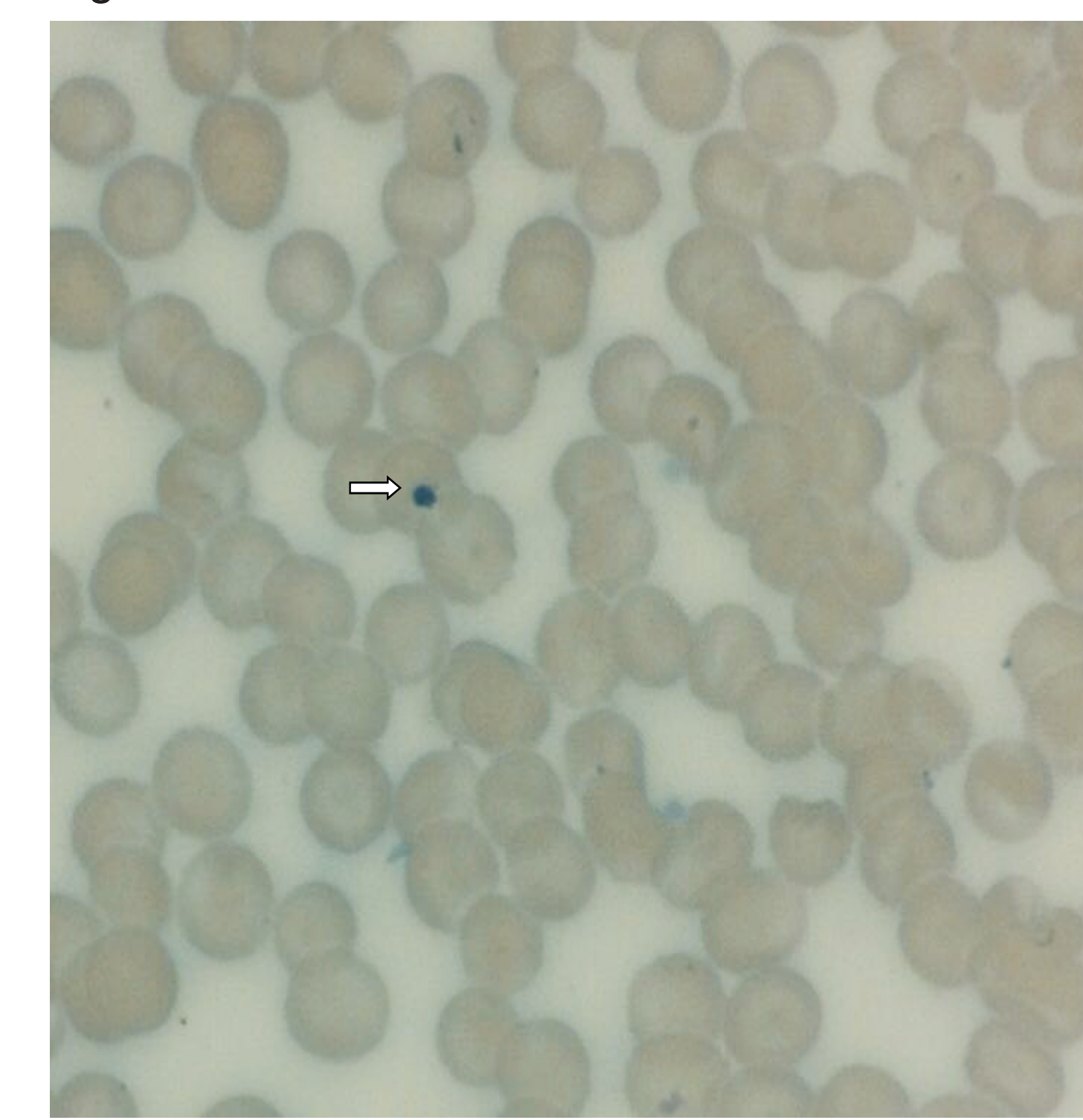


Figure 2



Micronucleus must have a round shape and be unique in erythrocyte