Comparative retrospective survey of environmental chemical principles on human fertility

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SUMMARY: Comparative retrospective survey of environmental chemical principles on human fertility.

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The widespread use of aniline, nitro compounds and heavy metals (Cadmium, Lead and Mercury) led to human exposure, with consequences on fertility. Phthalates are quickly metabolized into their monoesters and further into oxidative products, which are glucuronidated and are excreted in the urine and in the feces. Several in vitro studies showed that various types of environmental pollutants quoted, can interact with human endocrine system, interfering with the reproductive capacity. In this study, 355 couples were recruited from Assisted Reproduction Center, by retroactive screening concerning ART center in connection with law on security about work environment. Urine samples were taken and aforementioned chemical principles were analyzed using an analytical method. Results were compared in randomized form with those of an equivalent control group and statistical analysis revealed a significant difference between the two groups in terms of urinary concentration of these chemical principles.

KEY WORDS: Endocrine interference - Phthalates - Biological monitoring - Infertility - Environmental exposure - Case-control study.

Introduction

In the present study chemical principles represented by phthalates, aniline, nitro compounds and heavy metals (Cadmium, Lead, and Mercury), which are present in the urine, were examined in infertile couples candidate programs PMA.

The dermal and inhalation exposure is considered the most important routes of exposure to these environmental contaminants.

Exposure to environmental contaminants has been associated in several studies to reproductive diseases such as birth defects, ovarian and testicular cancer and conditions sterility/infertility (1).
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In fact, the action of phthalates is ubiquitous at the organic level, occurring in the liver, kidney and male and female genital, at that level through an antagonist mechanism in particular of sexual steroid hormones or directly at the level of the target organ (2).

Moreover the effects observed at the level of the male reproductive system were: a reduction in the production of testosterone and its conversion to the active form, represented by dihydrotestosterone (3, 4).

The dysfunctional action by phthalates starts on human endocrine system from the prenatal period, during intrauterine life, adding to a reduced reproductive capacity and quality of seminal fluid, as it has been reported during the second half of the twentieth century in industrialized countries (5-9).

Some multicenter studies present preliminary indices for which the urinary concentration of environmental contaminants is often associated with alterations of the characteristics of human semen and a variation of the same (10, 11).

In reference to the female reproductive system, several epidemiological studies showed an estrogenic activity by phthalates, both in vitro and in vivo, with particular reference to estrogen-dependent diseases such as endometriosis (12, 13).

The metabolites of environmental contaminants in the urine were used as biomarkers to determine the exposure to these chemical principles of general population and specific population groups (14).

The purpose of this study is to evaluate the possible environmental and occupational exposure to different active principles such as aniline, nitro compounds and heavy metals (Cadmium, Lead and Mercury) of couples with sterility/infertility problems, through the measurement of their urinary metabolites using a validated analytical method for their quantitative analysis.

Materials and methods

Study groups

In this study, 355 couples inhabitants in various Italian regions, were enrolled in a multicenter collaborative study in relation to the safety regulations in the workplace, in order to determine whether the urinary levels of metabolites of described environmental contaminants were higher than those of the couples in the control group, residing in the same geographical area, and with a positive reproductive family history. The mean age was 39.57 years (standard deviation 6.29, range 26-59) for cases and 27.5 years (range 20-35 years). For each couple was taken a sample of urine (15).

Preparation of urine samples

Urine samples, collected in sterile containers, were analyzed with specific methods for each chemical principles.
Results

Results of urine analysis

The values of the chemical principles found in the urine are indicated as a percentage in Figure 1. Statistical analysis reveals that for all the metabolites present the urinary concentrations are significantly higher for the cases in question compared to the control groups.

Conclusions

The results of biological monitoring of exposure to various types of chemical principles analyzed in this study, examining their concentration in the urine samples of 355 couples with sterility/infertility problems compared with those of an equivalent control group with positive reproductive family history, has detected a higher excretion of these chemical principles in the aforementioned pairs, with a significant difference between the two groups. This confirms the hypothesis that exposure to these chemical principles, from various environmental sources, can affect fertility in both male and female (12-15).

Further experience will be needed in order to verify a possible correlation between the individual assessment of exposure to iatrogenic agents, through biological monitoring, with particular reference to the lifestyle, as well as working environments contaminants, which act as dysfunctional endocrine factors on human fertility.

References