

## THE EFFECTS OF PARTICULATE MATTER ON THE FUNCTION OF LOWER URINARY TRACT IN FEMALE RATS

### Hypothesis / aims of study

As the progress of industrialization and urbanization, air pollution is becoming serious. Particulate matter (PM) is an important pollutant, and it is harmful to human health. Previous studies have reported that PM affects respiratory, cardiovascular, reproductive, endocrine and immune systems, and shown that PM is a kind of systemic toxicity factor. However, there has not been the research about the effect of PM on the lower urinary tract. This research aims to study whether PM affect the function of lower urinary tract in female rats and its possible impact mechanisms.

It is reported that PM has effect on cardiac autonomic regulation, and autonomic nervous system plays an important role in the control of voiding behavior of lower urinary tract. Whether PM affect the function of lower urinary tract through the effect on autonomic nervous system? So this study detects the change of choline acetyltransferase (ChAT) which is a synthetic enzyme of acetylcholine (ACh) in the bladder by immunohistochemistry and RT-PCR.

### Study design, materials and methods

PM standard sample is provided by the Public Health institute of Ohio State University. 64 SD female rats were randomly divided into two groups (n=32), one month and three-month exposure group, then each group was randomly divided into NS (control group), 0.16ug/ul (low concentration), 0.56ug/ul (medium concentration), 2.43ug/ul (high concentration) PM suspension exposure group (n=8). Different concentrations of PM suspension was instilled into rats through posterior pharynx. The amount of 24h water input, 24h urine output and 8h voiding frequency were observed using metabolic cages after exposure. The level of protein and gene expression of choline acetyltransferase (ChAT) in the bladder was detected by immunohistochemistry and RT-PCR.

### Results

The amount of 24h water input of rats have no significant difference ( $p > 0.05$ ). With the extension of exposure time and the increase of exposure concentration, 24h urine output and 8h voiding frequency have the trend to increase, 8h voiding frequency in three-month low, medium and high concentration exposure groups were significantly higher than the control group ( $P < 0.05$ ) (Table 1)

The positive area of protein expression of ChAT in immunohistochemistry and the intensity ratio of ChAT / $\beta$ -actin in electrophoresis band have the trend to increase with the extension of exposure time and the increase of exposure concentration, but only 3-month high concentration exposure group was significantly higher than the control group ( $P < 0.05$ ).

Table 1 The amount of 24h water input, 24h urine output and 8h voiding frequency \*\*

group	24h water input		24h urine output		8h voiding frequency	
	1 month	3-month	1 month	3-month	1month	3-month
NS	9.75±3.28	9.50±3.50	5.63±1.90	5.62±2.43	2.88±0.64	2.63±0.74
0.16ug/ul	10.13±3.72	10.50±5.32	7.31±6.46	22.75±26.03#&	3.13±0.64	3.63±0.52#
0.56ug/ul	13.75±4.50	10.38±5.29	9.44±2.47	12.19±3.14	3.63±1.06	4.00±0.93#
2.43ug/ul	13.75±4.37	8.63±3.00	10.56±2.23	4.13±2.03	4.00±0.76*	4.75±1.28#

\*\*Data are the mean±SE from 8 rats for each group

\* $P < 0.05$ , exposure group compare with control group in one month group

# $P < 0.05$ , exposure group compare with control group in three-month group

& $P < 0.05$ , three-month group compare with one month group in the same concentration

### Interpretation of results

These results exhibit that PM cause the change of 24h urine output, 8h voiding frequency and the expression of ChAT, and the trend of change of the 8h voiding frequency and the expression of ChAT are the same. It is indicated that PM may affect the voiding behavior through the effect on the expression of ChAT. It may that PM cause the autonomic nervous system which control of voiding behavior of lower urinary tract stimulated, the synthesis of acetylcholine (ACh) increased, micturition reflex increased and voiding frequency increased.

### Concluding message

Particulate matter affects the function of lower urinary tract in female rats, and the effect is gradually worsened with the extension of exposure time and the increase of exposure concentration. The impact of PM on the autonomic nervous system which control of voiding behavior of the lower urinary tract may be a mechanism.

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What were the subjects in the study?	ANIMAL
Were guidelines for care and use of laboratory animals followed or ethical committee approval obtained?	Yes
Name of ethics committee	Ethics committee of Fujian Medical University

