Weather and the Incidence of Urinary Stone Colic in Tokyo

by

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ABSTRACT. - One hundred and thirty-four episodes of stone colic occurring in one center in 1984 were studied. Urinary stone formation was frequent in the hot season. Actual daily climatic factors which provoked the stone to cause colic were examined. Falling barometric pressure was followed by a high incidence of colic, and rising pressure was followed by a low incidence. Falling air temperature in the cold season and rising temperature in the hot season were associated with high incidence of colic.

INTRODUCTION

Acute myocardial infarction has been reported to be provoked by thermal stress (Sotaniemi, 1970; Freeman, 1976), as evidenced as a seasonal fluctuation in incidence. Our previous study on the relation of ureteral stone colic and the weather, based on a rural population situated in the center of Japan, disclosed that episodes of ureteral colic were provoked on warm days with falling barometric pressure (Fujita, 1979). The present study on a metropolitan population living in Tokyo revealed clearer tendencies which might share common features with myocardial infarction.

MATERIALS AND METHODS

The National Medical Center Hospital is situated in the central western region of Tokyo. Patients visiting the outpatient clinic, from January 1 to December 31, 1984 were studied. There were 134 episodes of urinary stone colic in 366 days. The urinary stones were predominantly composed of calcium phosphate or oxalate. In most cases, stones smaller than 1 cm were found in the ureter on X-ray. The exact day when the colic began was recorded. Cases outside of the area when colic started were excluded.

The daily climatic conditions of the metropolitan area recorded by the Tokyo Meteorological Station, located about 4 kilometer east of the hospital, was used for the study. Daily values of weather variables were determined as the mean of 4 observations at 6 hourly intervals.

The incidence of stone colic was analysed in relation to the mean daily barometric pressure, temperature, relative humidity, rainfall, and wind. Several indices characterizing the climatic condition of the day were calculated as follows:

Pressure change: Air pressure of the day was compared with the previous day.
Warmer day and colder day: Temperature of the day was compared with the monthly mean.

Comparison with neighbouring days: Temperature of the day was compared with the mean of the 4 neighbouring days; i.e., the 2 preceding days and 2 following days.

Temperature change: Temperature of the day was compared with the previous day.

The differences in incidence were examined by $\chi^2$ test.

RESULTS

Daily records of the colic incidence, barometric pressure and temperature of the year are shown in Figure 1. The monthly incidence was high in summer with maximum of 19 cases in August. The occurrence of colics was clustered together and apparently provoked by the pressure fall.

Table 1 demonstrates the colic incidence per day in relation to climatic conditions. Stone colic preferentially occurred on days with low barometric pressure and seldom on days with high pressure. The tendency became significant when the incidence was analysed in relation to the pressure change. Days with a pressure fall of more than 5.0 mb were associated with a significantly elevated incidence of colic. Conversely, days with a pressure rise of more than 5.0 mb were associated with a significantly lower incidence. A highly significant difference was observed between the days with more than a 5.0 mb fall and those with more than a 5.0 mb rise ($p<0.001$).

Hot days were associated with a high incidence of colic. This is a simple reflection of the seasonal increase in summer. To minimize the seasonal effect, daily temperatures were compared with the monthly average. Days warmer than the monthly average had a higher incidence of colic than colder days but this trend was not significant. Daily temperature was compared with the 4 neighbouring days, and days with a rising temperature by over 1°C were associated with a significant high incidence of colic.

Comparing the temperature with the previous day a high incidence of colic on days with a more than 2°C temperature rise was observed. By dividing the days into two groups of temperature rise and fall, however, both groups showed nearly the same incidence. One year was divided into two periods of May-October and November-April. The former hot season had an incidence of 79 colics/184 days (0.4293) and the latter cold season had an incidence of 54 colics/182 days (0.2967). In the hot season, days of temperature-rise were associated with a high stone incidence. Conversely, days in the cold season with a temperature-fall were associated with a high colic incidence. The difference in the incidence of colic on rising days was not significant between the hot season and cold season, but it was significant on falling days between the hot season and cold season ($p<0.05$).

Days with a relative humidity of less than 50% had a low incidence of colic ($p<0.10$). The days with less than 50% were distributed either before May 10 or after October 15 with 2 exceptions. It means that here in Tokyo most of dry days were cold days in winter.

The relationship of effects between pressure-fall and temperature-rise was examined (Table 2) and these variables well found to be independent.