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Chloride ion concentration in vaginal discharge and urine during puberty

By

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In 27 prepubertal-pubertal girls the chloride ion concentration in vaginal discharge and urine was estimated four times during the menstrual cycle by means of a direct new micromethod using a Cl-selective electrode. In pubertal girls the chloride content showed changes both in vaginal discharge and in urine; the latter changed practically parallel with the vaginal value. A sharp rise in chloride content characteristic of normal ovulation was observed in 5 patients free from hormonal disturbances, while there were significant differences during ovulation 5 times and in the premenstrual phase 6 times in the girls with hormonal disturbances.

Cyclic changes in cervical mucus are considered important in gynaecological pathology. It has been shown that among the physical and chemical properties of mucus, the salt content determines its rheologic condition. The crystalline fern formation appearing during ovulation is composed of sodium and potassium chloride together with mucin-like substances [3]. Since it is difficult to prove ovulation in pubertal girls, it seemed interesting to study the chloride ion concentration in vaginal discharge and urine during the different phases of the menstrual cycle during puberty.

MATERIAL AND METHODS

In the study, 27 prepubertal and pubertal female patients were involved. Their diagnoses were as follows. Six had secondary amenorrhoea; 3 intermittent amenorrhoea; 8 suffered from vaginal mycosis; 3 from trichomoniasis, 1 was in premenarche and 1 in postmenarche. The patients were examined four times during a complete cycle: 1. during menses, generally at 2 days; 2. in the proliferative phase, at 6—12 days; 3. during ovulation, at 13—16 days; 4. in the secretory phase, at 17—24 days.

Fluid was aspirated from different sites of the vagina, mostly from the cervix, by means of a tuberculin syringe. In samples of more than 0.05 ml obtained from different sites of the vagina, the ion contents were comparable. This simple technique caused no difficulty in studying virgins.

The chloride content was estimated by means of a selective chloride-sensitive ceramic filter Ag/AgCl type electrode (Type OP-Cl-7111-D, made by Radelkis Co., Budapest), with a KNO_3 salt-bridge (Radelkis type OP-8201) which allowed to set the potential to a constant value independently of the concentration of the calibrating solution and of that of the sample.

As the specific gravity of the samples was unknown, the chloride ion content was expressed in g per 100 ml (See Fig. 1).

Every sample was examined for bacteria, parasites and fungi, and a Papanicolaou smear was also studied.

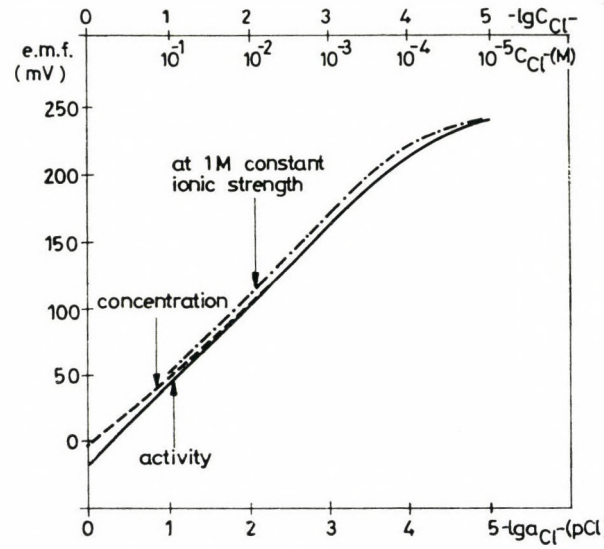

FIG. 1. Estimation of chloride ion content

RESULTS

In pubertal girls the chloride content showed changes both in vaginal discharge and in urine; the latter varied roughly parallel with the vaginal findings. The ratio of vaginal and urinary chloride was 1.33 ± 0.04; the scattering of values was 0.21. The values within 95% confidence limits yielded a significant difference 5 times during ovulation and 6 times in the premenstrual period. In Fig. 2 it is seen that during menstruation the values for Cl ion content moved between 0.5 and 0.6 g, independently of previous high or low ion concentrations. In the ovulatory period, a sharp rise in chloride content, characteristic of normal ovulation, was observed in 5 patients free from hormonal disturbances (Fig. 3).

In the patients with vaginal mycosis there were no significant differences in the types of cultivated fungi. In all these cases the chloride content

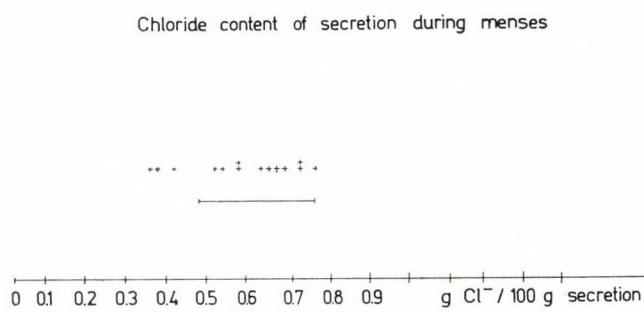

FIG. 2. Chloride content of vaginal secretion during the menstrual cycle

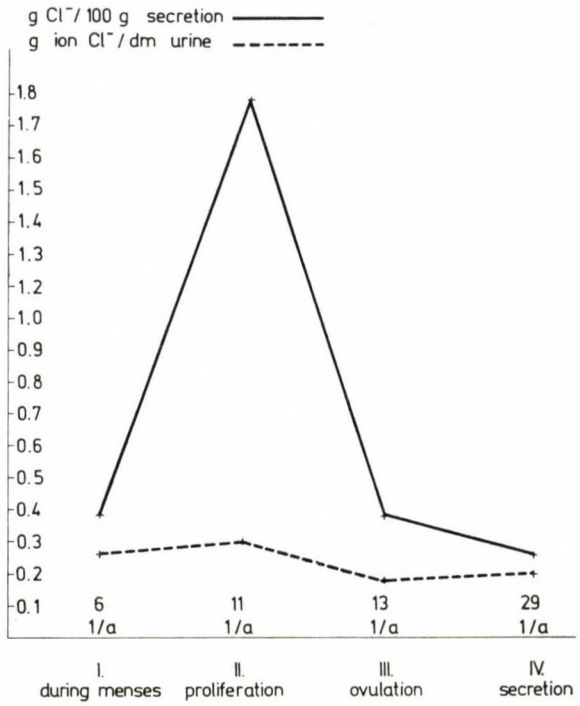

FIG. 3. Vaginal and urinary chloride content during the menstrual cycle

was very low but did not fall below the lowest normal limit. Only two differences were significant statistically, one in premenarche, and the other in postmenarche; it is well-known that in these periods there is a high oestrogen content in blood and tissues.

DISCUSSION

Studies on the changes of the chloride content during the different stages of the menstrual cycle, especially in pubertal girls, are lacking in the literature. Therefore, our results could not be compared to existing data. Michelakis et al. [4] studied sodium space and urinary sodium, potassium and creatinine excretion during the menstrual cycle in normotensive subjects under controlled sodium intake. The time of ovulation was determined by basal temperatures and urinary pregnanediol excretion. No significant changes in sodium space were noted during the phases of menstrual cycle, but these authors had neglected to measure the vaginal secretion of chloride which, as demonstrated by the present study, changes considerably during the menstrual cycle. Crocker [1] examined mucosal water and sodium transfer in the rat and found that mucosal water transfer was higher in prooestrus and oestrus than in metoestrus and dioestrus.

This suggested that the action of ovarian steroids on water and electrolyte metabolism was due to the increased activity of both the adrenal cortex and the renin-angiotensin system. El-Naggar et al. [2] studied cows in different phases of the oestrous cycle and showed that during heat the mean chloride content of cervical mucus amounted to 869.2 mg/100 ml, significantly more than during any other phase of the cycle.

From the present results a sharp rise of the chloride content of the vaginal discharge was apparent during the period of ovulation. The increase coincided with follicular maturation and oestrogen production and was ascribed to the increased blood flow of the internal genitalia during ovulation. The result is an increase in vascular permeability and a subsequent increase in mucosal water and salt excretion. In pathologic conditions high chloride values occurred also premenstrually. The explanation of the low chloride ion content found in vaginal mycosis is that the fungi themselves utilize the chloride together with carbohydrates.

To sum up, chloride ion content of the vaginal discharge may supply information concerning the ovulation period in pubertal girls.

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