

# DETECTION OF OVULATION BY ESTIMATION OF LEVELS OF CHLORIDE IN CERVICAL MUCUS

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## SUMMARY

In an attempt to detect ovulation by estimation of cervical mucus chloride levels, cervical mucus chloride estimation and fern test were done at least thrice in the same cycle, once before the twelfth day, once at mid cycle and then repeated in premenstrual phase. Premenstrual endometrial biopsy was taken as a standard parameter for detection of ovulation.

Chloride levels in cervical mucus were found to be below 100 mEq/litre between the 7th to 12th day and after 7th day of the cycle. Between 13th to 16th day of cycle i.e. presumed days of ovulation the levels increased above 100 mEq/litre in ovulatory cycles. Levels remained low in anovulatory cycles. A positive correlation was observed between chloride levels and degree of cervical mucus arborisation. Ovulatory cycles were detected in 91.1% cases by chloride levels and in 98.8% by cervical mucus fern test. In 94.7% cases cycles were found to be anovulatory by both cervical mucus chloride estimation and degree of arborisation in comparison to endometrial biopsy.

### Introduction

The alteration in cervical mucus have been the subject of extensive research and review. During the periovulatory period the viscosity of cervical mucus drops, spinnbarkeit increases and characteristic fern patterns appear upon air drying. These changes which are conducive to penetration by spermatozoa are accompanied by an increase in water content, increased concentration of certain electrolytes particularly Na and Cl, and

alteration in the quantity and quality of proteins present. Keeping this in mind an attempt has been made to evaluate variations of chloride level in cervical mucus during the menstrual cycle and its utility in predicting ovulation.

### Material and Methods

The study included 100 women who attended the outpatient department of Obstetrics and Gynaecology MLN Medical College, Allahabad. These cases were divided into two groups.

Group A: Included 80 cases of infertility, 67 of primary infertility and 13 of

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secondary infertility. The following criteria were observed in selecting cases:

(a) Primary infertility: Period of infertility one year or more. (ii) Age between 18 and 35 years, (iii) Regular menstrual cycles, (iv) Clinical findings essentially normal, (v) Husband found to be normal after physical examination and semen analysis.

(b) Secondary infertility: Included cases with inability to conceive after 5 years of last child birth.

Group B: Included 20 fertile cases of same age group, with no clinically detectable genital pathology.

Cervical mucus was collected by a glass pipette with bulb suction at least thrice in the same cycle i.e. once between 7th to 12th day of cycle, once at mid cycle between the 13th to 16th day i.e. at the expected time of ovulation and then repeated in the pre-menstrual phase.

Mucus was divided into 2 parts first part was spread on a dry glass slide and it was allowed to dry and then examined under a microscope for arborisation. Second part of mucus was tested for levels of chloride by titration method. The value was obtained by the standard formula.

Chloride level (mEq/litre) = Silver nitrate solution utilized in ml x 100.

In all cases premenstrual endometrial biopsy was done in the same cycle and was considered as the standard method of detection of ovulation.

#### Observations

##### Chloride levels in infertile patients:

Chloride level in cervical mucus was below 100 mEq/litre between the 7th to 12th day of the menstrual cycle in 95% cases. Between the 13th to 16th day of cycle majority of cases (62.5%) had chloride levels between 100 to 200 mEq/litre. Seven patients (8.6%) had chloride level between 200 to 250 mEq/litre and it was above 250 mEq/litre in 4 (5%) patients. The highest value recorded was 360 mEq/litre in one case. The chloride levels were below 100 mEq/litre in majority of patients (97.5%) between the 17th to 22nd day of the cycle (Table I).

##### Chloride levels in Fertile Women:

Majority of fertile patients (95%) showed chloride levels below 100 mEq/litre between the 7th to 12th day and in premenstrual phase between 17th to 22nd day. However, it was above 100 mEq/litre between 13th to 16th day of cycle in 85% women (Table II).

TABLE I  
Chloride Levels in Infertile Patients

Sl. No.	Chloride level in mEq/Litre	Days 7-12		Days 13-16		Days 17-22	
		No. of cases	%	No. of cases	%	No. of cases	%
1.	0-50	17	21.2	2	2.5	19	23.7
2.	50-100	59	73.8	17	21.2	59	73.8
3.	100-150	4	5.0	22	27.5	2	2.5
4.	150-200	—	—	28	35.0	—	—
5.	200-250	—	—	7	8.8	—	—
6.	250 and above	—	—	4	5.0	—	—
		80		80		80	



TABLE II  
Chloride Levels in Fertile Patients

Sl. No.	Chloride level in mEq/Litre	Days 7-12		Days 13-16		Days 17-22	
		No. of cases	%	No. of cases	%	No. of cases	%
1.	0- 50	4	20	1	5	2	10
2.	50-100	15	75	2	10	17	85
3.	100-150	1	5	7	35	1	5
4.	150-200	—	—	8	40	—	—
5.	200-250	—	—	1	5	—	—
6.	250 and above	—	—	1	5	—	—
		20		20		20	

*Correlation between chloride level in cervical mucus and degree of arborisation in mild cycle:*

All cases with chloride levels above 250 mEq/litre, had PL+++ . Out of 8 cases with chloride level between 200 to 250 mEq/litre 6 (75%) had PL+++ and 2 cases (25%) had PL++. In 36 cases who showed chloride level between 150 to 200 mEq/litre 17 (47.2%) had PL+++ and 19 cases (52.8%) had PL++. Out of 29 cases with chloride level between 100 to 10 mEq/Litre, 2 cases (6.9%) had PL+ 4 cases (21.1%) had PL++, 11 cases (57.8%) had PL+ and 4 cases (21.1%) showed PL test negative when cervical mucus chloride level was between 50-100 mEq/litre. All the 3 cases with chloride level below 50 mEq/litre showed PL reaction to be negative.

Correlation between chloride level in cervical mucus at midcycle and ovulatory/anovulatory cycles:

All cases with midcycle chloride level above 150 mEq/litre and 96.6% cases with 100-150 mEq/litre chloride level were observed to have ovulatory cycles. In all these cases endometrial biopsy revealed secretory endometrium. Out of 19 pati-

ents showing anovulatory cycles 94.7% had chloride level below 100 mEq/litre.

For detection of ovulation the accuracy of chloride estimation and fern test with endometrial biopsy was compared. It was found that chloride estimation to be 95% accurate and cervical mucus fern test 98.8% as compared to E. B. Anovulatory cycles when detected the accuracy was 94.7% with chloride estimation as well as fern test.

#### Discussion

Zondek and Rozin (1954), McSweeney and Sbarra (1964) found that concentration of sodium per unit weight of fresh mucus fluctuated cyclically in the menstrual cycle. McSweeney and Sbarra (1964) by using a spot test for chloride estimation found the increase in level from 1% in the early proliferative phase to 0.9% at the presumable time of ovulation; after ovulation chloride level dropped to below 0.5%. Hardy *et al* (1970) found maximum chloride level on the day of ovulation as evidenced by brightest positive chloride spot on the test paper, and found that the mean concentration of sodium in fresh mucus varied between

72 to 95 micro-mole sodium in fresh mucus. The maximum level of sodium (107 to 196 micro-mole/gm) occurred on the day of ovulation and was usually preceded by a surge from a relatively low value 1 to 2 days prior to ovulation. Singh and Boss (1973) found sodium chloride level to be constant at 100 to 150 milimole per kg throughout the cycle. However in dry residue there were cyclical variations in the level with very sharp rise during the midcycle.

In the present study chloride levels have been found to be below 100 mEq/litre between the 7th to 12th day and after 17th day of menstrual cycle in majority of patients. Between 13th to 16th day of cycle i.e. on presumed days of ovulation the levels were above 100 mEq/litre in ovulatory cycles. However it was low in anovulatory cycles.

The accuracy of chloride spot test, and fern test with endometrial biopsy was compared. They found the chloride spot test to be 94% accurate and fern test 97.82%. Roland (1952), Zondek and Rozin

(1954) detected the accuracy of cervical mucus fern test to be 100%, 85% and 89.4% respectively as compared to endometrial biopsy.

*Conclusion*

The estimation of chloride levels in cervical mucus is fairly accurate inexpensive, quick and simple method for detection of ovulation and in absence of facilities for proper histopathological studies which are invasive and other sophisticated tests.

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