

THE VALUE OF VAGINAL CYTOLOGY IN THE PREDICTION OF THE ONSET AND NATURE OF LABOUR

by

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The pioneers in the study of vaginal cytology in late pregnancy were Lemberg, Stamm and De Watteville who, in their report at the International Congress of Gynaecology & Obstetrics, 1954, stated that, "vaginal smears show characteristic modifications during pregnancy and maintain a surprisingly uniform appearance as long as the course remains normal. Approaching term and imminent delivery are reflected by a change in the smears which should allow better selection of patients for induction of labour."

Their findings were:—

In advanced pregnancy: 36th to 39th week — A heavy desquamation of intermediate cells of the navicular type, few leucocytes and more or less mucus; cytolysis very rare.

One week before term: Desquamation was less intense with plaques of navicular cells, cytoplasm was paler and there were more leucocytes and mucus.

At term: Slight desquamation with almost complete disappearance

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Received for publication on 19-9-65.

of navicular cells. Discrete cells of the superficial type with small nuclei and paler cytoplasm. Marked leucocytes and mucus.

The correlation of their findings with the term of pregnancy was 90%. Since then other workers have stressed the importance of various other criteria in the detection of term and post-term (prolonged pregnancy) smears. 1. Cytolysis. (Dexeus and Segur, 1957, Ezes, 1953). 2. "Regression factor" — an inversion of the superficial intermediate/deep intermediate cell ratio with the appearance of basophilic parabasal cells, similar to those seen in the early puerperium. (Boorsma, 1958, Guilhelm *et al.*, 1953).

These two factors when associated with clinical post-maturity suggest impaired placental function (Ezes, 1953).

These findings, however, have not been corroborated by all workers. Opinion on the value of vaginal cytology is divided. Some authors claim that the onset of labour can be predicted to within 5-7 days with an accuracy of 90% (Pundel, 1962 Leeton, 1963).

Others find that though decreasing desquamation with smaller cell clusters is observed, this begins several weeks before delivery and there is no definite temporal relation-

ship to onset of labour (Abrams, 1962). The change is neither sufficiently distinctive (Hindman, 1962) nor sufficiently consistent (Bourg, 1962) to permit reliable recognition of term smears in all cases.

To sum up, the cytological criteria with their hormonal significance are:

1. *Desquamation*: As in the menstrual cycle, progesterone influence leads to heavier desquamation of intermediate type cells.

2. *Acidophilia*: Though this is said to be a sign of oestrogen dominance, the cytoplasmic colour is frequently very misleading. Acidophilia is also found in the presence of infection, excessive drying before fixation, or in a thick smear.

3. *Pigment*: Depigmentation at term is an observation for which there is no hormonal explanation.

4. *Leucocytes and mucus*: Indicate progesterone dominance as they are best seen in the premenstrual phase of the menstrual cycles.

5. *Cytolysis*: Occurs in the presence of heavy infection with Döderlein's bacilli and so is a sign of oestrogen dominance.

6. *Cell type*: The navicular or intermediate cell is predominant in pregnancy and signifies vaginal hyperplasia as a result of high oestrogen and progesterone production. As cornification is an oestrogen effect, more superficial cells, i.e. pre-cornified and cornified, should appear when oestrogen effect dominates. The deeper parabasal cells indicate a fall in both oestrogen and progesterone as occurs in the post-partum smears. They are called "postnatal" cells.

Though each criterion can be explained on a hormonal basis, no cor-

relation has been detected between the vaginal smear and oestradiol: pregnanediol ratios in the urine at term. (Gsel and Rosenblatt, 1957).

This study was carried out to assess the value of vaginal cytology in predicting the maturity of the foetus, the imminence of labour and the nature of labour.

Material and Method

Vaginal smears of scrapings from the lateral vaginal wall were fixed in a mixture of equal parts of 95% alcohol and ether and stained with Papanicolaou's stain. These were studied in:

77 patients with single smears, 0-24 hours before delivery (63 in active labour).

50 patients with single smears, 1-7 days before delivery (22 in false labour).

15 patients with 3-4 weekly smears each in the last 4 weeks of pregnancy.

24 patients with single smears in the 3rd trimester.

Cases of toxæmia in which the hormonal pattern was likely to be altered were excluded. The weight of the baby was noted in each case to exclude cases of premature labour. The length of labour and efficiency of uterine contractions were also noted in each case.

Observations

I. *Maturity and onset of labour*: The general impression was that as term approaches desquamation decreases, pigmentation is poorer, leucocytes and mucus increase and there is a decrease in navicular cells with increase in the cornified and pre-

TABLE I

Maturity	Desqua- mation	Acido- philia	Pig- ment	Cyto- lysis	Para- basal	Navi- cular	Pre- corni- fied	Corni- fied	Leuco- cytes & mucus
Third tri- mester	Good to fair	Moderate	Good	25% of smears	—	++	+	Occa- sional	Poor
36th to 39th week	Good to moderate	Moderate	Good	50% of smears	—	++	+	Occa- sional	Poor
1-6 days before delivery	Good to moderate	Moderate to poor	Good	66% of smears	—	++	+	Occa- sional	Good to poor
0-24 hours before delivery	Moderate to poor	Moderate to poor	Moderate to poor	66% of smears	Occa- sional	+	+	Moderate	Good to moderate

cornified cells. Occasionally para-basal cells appear. (Table I).

As so many variable criteria are involved and each smear has different combinations of these, no generalisation is possible at any particular phase. However, as term approaches and labour starts two patterns are seen with greater frequency.

Type I. Clean smear, with discreet cells, precornified predominating over navicular type and greater acidophilia (Fig. 1).

Type II. Dirty smear with clumps of disintegrating cells i.e. good cytolysis, with large number of Döderlein bacilli, acidophilia poor, mucus and

leucocytes variable. The type of cell cannot be distinguished due to marked cytolysis. (Fig. 2).

Type III. All other smears that do not fit into type I and II. (Fig. 3).

The distribution of these cytologic patterns is shown in Table II.

The patterns Type I and II (together) appear with the greatest frequency when labour, true or false begins (when prediction regarding onset of labour has no value) — 63.6% in false and 70% in true labour; 50% of 24 hours — 8 days before labour and 40% of third trimester smears also show these patterns. Therefore they have no significance in the prediction of the

TABLE II

Maturity	Type I	Type II	Type III
Third trimester	6 (25.0%)	4 (16.6%)	14 (58.4%)
36 to 39th week	7 (14.6%)	12 (25.0%)	29 (60.4%)
1-7 days before delivery	13 (26.0%)	11 (22.0%)	26 (52.0%)
0-24 hours before delivery	27 (35.0%)	13 (17.0%)	37 (48.0%)
False labour (Delivery in 1-8 days)	12 (54.6%)	2 (9.1%)	8 (36.3%)
Active labour (Delivery in 24 hours)	22 (35.0%)	22 (35.0%)	19 (30.0%)

(Percentages in brackets).

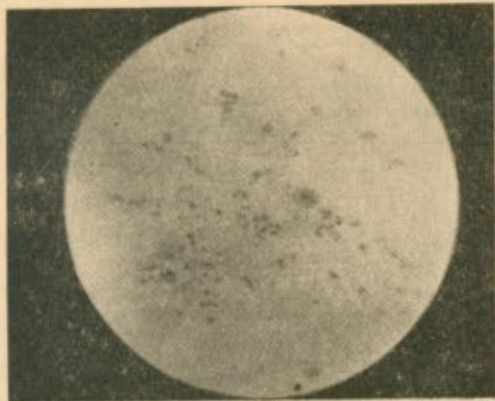


Fig. 1

Type I Smear. Discrete superficial cells with pale cytoplasm and marked leucocytosis. Parabasal cells seen.

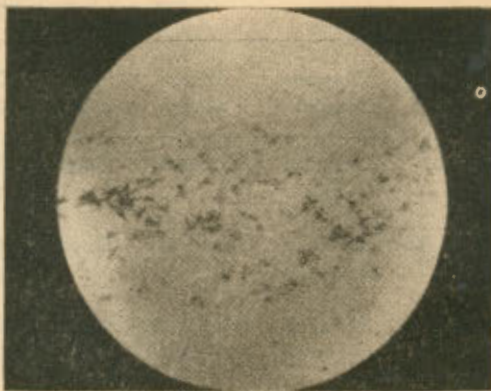


Fig. 2

Type II Smear. Dirty smear with clumps of disintegrating cells (cytolysis) with Doderlein's bacilli in large numbers.

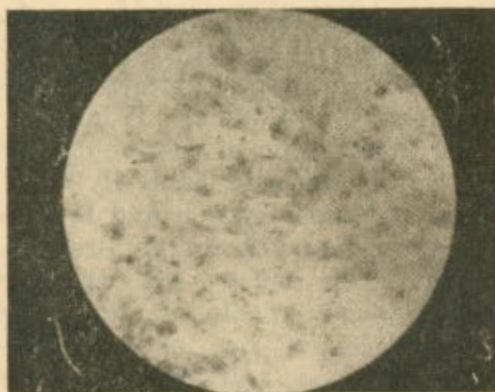


Fig. 3

Type III Smear. Heavy desquamation of clumps of navicular cells.

II. *Nature of labour*: The duration of labour gives an idea of the efficiency of uterine action. Table III shows the duration of labour in the 3 cytological types, in smears taken 0-48 hours before delivery (before the onset of labour and in labour).

The percentage of cases falling in each of the four groups, 0-12 hours, 12-24 hours and 24-48 hours and false labour, was almost the same for each of the three types of smears. The efficiency of uterine action in labour therefore could not be predicted, as there was no significant difference in the duration of labour in each of these vaginal patterns.

onset of labour or maturity of pregnancy.

III. *Postmaturity*: No observation

TABLE III

Cytologic pattern	0-12 hrs.	Duration of labour		False labour
		12-24 hrs.	24-48 hrs.	
Type I	14 (40.0%)	5 (15%)	3 (10%)	12 (35%)
Type II	15 (60%)	5 (20%)	2 (10%)	2 (10%)
Type III	14 (50%)	4 (15%)	1 (5%)	8 (30%)

(Approximate percentages in round figures in brackets).

on postmaturity could be made in this series as there were no cases of proved clinical postmaturity. However, at term parabasal cells appeared in 25% of cases in labour. Also the "Regression factor" (inversion of superficial intermediate/deep intermediate cell ratio) was seen in three of the fifteen cases in which a longitudinal study over the last 4 weeks was carried out while 5 cases showed no change and 4 showed fluctuating patterns.

Discussion

The conclusions drawn from this small series are that though the study of vaginal cytology is not reliable in predicting either the maturity of the foetus or the onset and nature of labour, it gives an insight into some of the changes in hormonal balance occurring at the onset of labour.

Opinion is still divided regarding the role of hormones in the onset of labour. Animal experiments on rabbits give definite proof that progesterone decreases the sensitivity of the uterus to oxytocics and its withdrawal leads to the onset of labour. (Reynolds 1949). In humans, recent workers have shown that the pregnanediol: oestriol ratio in the urine and serum remains unchanged (Aitken and Preedy 1958) and that plasma progesterone is at its maximum at term and falls after delivery on the first and second post-partum day (Deshpande and Sommerville 1958).

Csapo (1958) has advanced the theory of "Progesterone Block". According to this, progesterone drastically depresses excitability of the uterus by blocking the propagated

activity of the cell membranes. No substance is known that can activate an effectively blocked uterus. As the placenta is the main source of progesterone after the third month there is a concentration gradient of progesterone in the myometrium away from the placenta. When progesterone production decreases, the muscle opposite the placental site recovers, while the rest stays blocked. Thus depending on the location of the placenta, and rate of withdrawal of progesterone block, true or false labour begins. Uterine dysfunction and inco-ordination can also be explained on this basis. Stamm and Borth (1958) estimated the pregnanediol and oestriol in 24 hours' urine voided immediately or 24 hours before, in unsuccessful induction, successful induction and spontaneous labour. Neither the excretion levels, nor the ratios showed any difference. This indicates that onset of labour is probably not controlled by hormones.

In this study in confirmation of the findings of other workers, two patterns have emerged. But the important point is that the greatest correlation exists only after the onset of labour. A possible explanation would be that the mechanism of labour is initiated, not by a gradual change in the oestrogen/progesterone ratio, but by a trigger mechanism so swift in onset, that its first cytological indication only follows its clinical manifestations. This conclusion is at variance with the conclusion of Lichtfus 1959 that this change occupies the last 2 weeks of pregnancy and of Pundel (1959) and Leeton (1963) that it lasts 5 days — 7 days.

The fact that a particular cytologi-

cal pattern appears in labour is proof that a change of hormonal ratios does occur, if not at the onset of labour, definitely at some stage in labour. However, the efficiency or otherwise of uterine action and the outcome of labour must depend on other factors than hormonal as there was no correlation between the type of smear and the outcome of labour.

Summary

Two hundred and ten vaginal smears were studied in 166 women in late pregnancy. Though approaching term was reflected by a change in the smears, the change was not sufficiently consistent to be used as a reliable guide to the maturity of the foetus or the onset and nature of labour. However, in 70% of smears taken in labour a typical cytologic pattern was seen. A possible explanation for this is sought and discussed.

Acknowledgement

I thank Dr. M. K. K. Menon, M.D., F.R.C.O.G., Director Institute of Obstetrics & Gynaecology, Madras, for his guidance and encouragement in carrying out this study.

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