A HISTOLOGICAL AND HISTOCHEMICAL STUDY OF THE FALLOPIAN TUBES DURING VARIOUS PHASES OF THE MENSTRUAL CYCLE

by

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Attention has been focussed on the oviduct in the last few years with the heightened need for population control. Although organogenetically, the fallopian tube is of the same Mullerian origin as the uterus and the upper vagina, it has received considerably less attention than the rest of the reproductive tract. For a long time it continued to be considered as a passive tube conveying sperms and eggs in the opposite directions and clinically, its patency has been of prime importance. In addition it provides environmental conditions for ovum transport, capacitation and fertilisation. The fallopian tube epithelium provides the essential nutritional interrelationship between the cleaving morula and the surrounding tubal lumen. It is obvious that the studies of the structure and cytochemical function of the endothelium of the fallopian tube carries important implications for both the prevention and the facilitation of the conception.

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In view of the extreme importance of the tube, both from the point of view of infertility and more particularly its implications in the contraceptive practice, it was considered worthwhile to carry out the present study with the following aims and objects:

1. To study the histological picture of the tube during the different phases of the menstrual cycle.

2. To study the histochemical changes during the different phases of the menstrual cycle.

3. To corelate these changes with vaginal cytology and endometrial histology where ever possible.

4. To corelate the information obtained with possible changes responsible for fertility.

Material and Methods

The present study was carried out in the Department of Obstetrics and Gynaecology and Department of Pathology and Bacteriology S.N. Medical College, Agra. The cases were seleced from those admitted to the Gynaecology wards for interval tubal ligation.

On the basis of detailed menstrual history of the patient, the cases were arbitrarily divided into the following catagories depending upon the phases of the menstrual cycle at the time of taking the biopsy.

1. Menstrual phase: (1st day to the 4th day of the cycle)
2. Proliferative phase: (i) Early proliferative phase (5th day to 9th day of cycle) (ii) Late proliferative phase (10th day to 14th day of cycle).
3. Secretory phase: (i) Early secretory phase (15th day to 19th day of the cycle), (ii) Late secretory phase (20th day to the 24th day of the cycle).
4. Premenstrual phase: (25th day to 28th day of the cycle).

The days mentioned above were counted from the first day of the menstrual cycle. To corroborate the phasing of the menstrual cycle, vaginal smears were studied and wherever possible endometrial biopsy was taken. The biopsies from the fallopian tubes and endometrium were preserved in alcohol for the following studies:

Observations

In the present study, 100 cases were observed with a view to study the histological and histochemical status of the tubal epithelium during the different phases of the menstrual cycle. The observations are summarised herewith:

1. There were no definite changes in the tubal histology with regard to the age, parity and past abortions of the case.

2. *Histology*:

(i) *Type of Mucosal Folds*: The mucosalfolds were of types IV and V mainly (i.e. longitudinal, complex medium or high and simple). There were no variations in type of mucosal folds during the different phases of the menstrual cycle (Table I).

TABLE I

Mucosal Folds and Luminal Secretions During the Various Phases of the Menstrual Cycle

S. No.	Phase of the Menstrual Cycle	Type of mucosal folds	Luminal Sections	
			Present	Absent
1.	Menstrual phase	IV, V	++	—
2.	Early proliferative phase	IV, V	—	—
3.	Late Proliferative phase	IV, V	±	—
4.	Early Secretory phase	IV, V	+	—
5.	Late Secretory phase	IV, V	++	—
6.	Premenstrual phase	IV, V	++	—

(ii) *Luminal Secretions*: There was significant change in the amount of luminal secretions during the different phases of the menstrual cycle. The luminal secretions were absent during the menstrual phase and in insignificant amount during the proliferative phase. During the secretory phase the secretions were present in significant amounts with a peak level at day 20 to 24.

(iii) *Lamina Propria*: (a) Thickness and vascularity—There was definite increase in the thickness and vascularity of the lamina propria from the menstrual phase to the premenstrual phase. During the menstrual phase the early proliferative phase and the late proliferative phase

the thickness of the lamina propria was maximum, upto the extent of one high power field. The thickness was of moderate degree, upto the extent of two high power fields during the early and the late secretory phases which started increasing from the late proliferative phase. The thickness was maximum, upto the extent of three high power fields during the premenstrual phase (Table II).

(b) Metachromatic granules — There was great variation in the metachromatic granules' presence during the different phases of the cycle. The presence was more significant during the secretory phase and the menstrual phase of the cycle (Table II).

(iv) *Luminal Epithelium* (a) *Epithelial Border*: The epithelial border was low and uniform during the menstrual and early proliferative phase. It was tall and uniform during the late proliferative and early secretory phase. Tall and irregular border was found in cases studied during the late secretory phase as well as the premenstrual phase (Table III).

(b) *Ciliated Cells*: The ciliated cells were low and broad during the menstrual and the early proliferative phase with pale cytoplasm and refractile apical nuclei. They were tall and broad during the late proliferative and the early secretory phases again becoming low and broad gradually during the late secretory and premenstrual phases. Thus maximum height was found during the late proliferative and the early secretory phase (Table III).

(c) *Non-ciliated Cells*: These cells showed characteristic and more evident

TABLE II

Lamina Propria During the Various Phases of the Menstrual Cycle

S. No.	Phase of the Menstrual Cycle	Lamina Propria		
		Thickness & Vascul.	PAS +ve Mat.	Metachromatic Granules
1.	Menstrual phase	+	+	+
2.	Early proliferative phase	+	—	—
3.	Late proliferative phase	+	±	±
4.	Early secretory phase	++	+	+
5.	Late secretory phase	++	++	++
6.	Premenstrual phase	+++	++	+

TABLE III

Lamina Epitheliasis During the Various Phases of the Menstrual Cycle

S. No.	Phase of the Menstrual Cycle	Lamina Epitheliasis			
		Epithelial Border	Ciliated Cells	Noncili-ated Cells	Inter Calary Cells
1.	Menstrual phase	L.U.	L.B.	L.N.	+++
2.	Early proliferative phase	L.U.	L.N.L.B.	L.N.	—
3.	Late proliferative phase	T.U.	T.B.	T.N.	—
4.	Early secretory phase	T.U.	T.B.	T.B.	—
5.	Late secretory phase	T.I.	L.B.	T.N.	±
6.	Premenstrual phase	T.I.	L.B.	T.N.	+++

cyclic changes during the different phases of menstrual cycle. The cells were cubical or low columnar during the menstrual phase and the early proliferative phases and were long columnar during the late proliferative and early secretory phases. During the late secretory phase and the premenstrual phases the cells were long columnar with frayed margins and showing emptying of their secretions in process or complete. Scattered emptied nuclei along with their cytoplasmic envelops in clusters were also found at the summits of mucosal folds adjacent to ciliated cells (Table III).

(d) *Intercalary Cells*: These types of cells were found as long slender interjected in between groups of cells mainly during the premenstrual and menstrual phase of the cycle. Only few cells were seen during the secretory phase and none during the proliferative phase (Table III).

The PAS +ve. material was found in the Lamina propria, ciliated cells as well as in non-ciliated cells. It was absent during the proliferative phase, present during the secretory phase and the premenstrual phase. The maximum concentration was found at day 22 to 24 of the cycle. In non-ciliated cells the PAS +ve. material was present mainly infranuclearly during the late proliferative and early secretary phase while the situation was supranuclear or even in the stage of emptying during the late secretory phase and the premenstrual phase.

Corelative study of the oviductal histology with vaginal cytology and endometrial histology during the first half of the menstrual cycle revealed that there is progressively increasing oestrogenic activity in oviduct as evidenced by absence of metachromatic granules, negative PAS +ve. reaction in lamina propria, a uniform epithelial border and absence of intercalary cells in lamina epitheliasis and absence of luminal secretions. During the second half of the menstrual cycle correlative study showed the changes in the oviductal histology due to progesterone effect as evidenced by increase in the thickness in the lamina propria, presence of metachromatic granules and a positive P.A.S. reaction, increase in height and irregularity of epithelial border, appearance of intercalary cells and the increased amount of luminal secretions (Table IV).

Discussion

Primary incentive for the present study was to determine, if possible whether a definite histological cycle can be described in the tubal epithelium which is in any way comparable to that seen in the endometrium and vaginal epithelium.

In our study types of the mucosal folds were mainly Types IV and V in accordance with the findings of Beck (1972).

It is evident from the present study that luminal secretions are absent altogether during the proliferative phase, start appearing at mid-cycle and continue to increase with a peak at day 20-24, they persist during the premenstrual and the menstrual phase. Bjorkman and Fredricsson (1964) and Roy and Roy (1972) were also able to demonstrate the luminal secretions in the oviduct during the secretory phase as evidenced in the present study and were progesterone dependent.

Beck (1972) found changes in the lamina propria thickness and vascularity with a peak during late secretory phase of the cycle which is in accordance with our findings. The cyclic variation in the thickness is hormone dependant.

In our study the cyclic variation in the epithelial border height was in accordance

TABLE IV

Correlative Findings of Oviductal Histology With Vaginal Cytology and Endometrial Histology

Phase of the Cycle	M.I.	Vaginal Cytology K.P.I.	Vaginal Cytology M.V.	Endometrial Histology Gland	Endometrial Histology Stroma	Oviductal Histology: Lamina propria Thickness	Lamina propria Pas +ve Mat.	Meta Chromatic Granules	Lamina Epithelial Border	Epitheliasis Intercalary Cells	Luminal Secretions
1. Menstrual—phase		—	—	Few Broken	Loose	+	+	+	L.U.	+++	++
2. Early Proliferative phase	0/40/60	60	80	Small Straight	Compact	+	—	—	L.U.	—	—
3. Late Proliferative phase	0/30/70	70	55	Medium Straight	Compact	+	±	±	T.U.	—	—
4. Early Secretory phasee	0/50/50	50	75	Medium Straight	Loose	++	+	+	T.U.	—	+
5. Late Secretory Phase	0/70/30	30	65	Long Tortuous	Loose	++	++	++	T.I.	±	++
6. Pre-Menstrual Phase	0/80/20	20	60	Long Tortuous	Loose	+++	++	+	T.I.	++	++

with the findings of Snyder (1924), Novak and Everette (1924) and Patek and Nilsson (1972, 1972, 1973, 1973) and is assumed to be hormone dependant. Our findings displayed presence of PAS +ve. material during the secretary phase in significant amounts with a maximum at day 22-24. The same findings were observed by Clyman (1966) and Arrata and Arronet (1971).

From the above findings it is evident that the normal tube plays no active part in the bleeding of menstruation. The tubal epithelium exhibits a definite cyclic histological and histochemical variation, so that careful study will with rare exceptions enable one to determine at what phase of the cycle it has been removed.

From the present study of cytochemical and structural function of the endosalpinx we can further implicate the factors responsible for the facilitation of conception as well as their prevention. By altering the tubal cytochemical function in the interval phase of the cycle we can achieve a goal against conception as well as treat the cases who are infertile.

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