STUDIES ON HUMAN FALLOPIAN TUBAL EPITHELIUM IN DIFFERENT AGE GROUPS

Jayasri Devi[1], Tribeni Medhi[2]

[1]Professor & HOD, Department of Anatomy, Fakhruddin Ali Ahmed Medical College, Barpeta.
[2]Assistant Professor, Department of Anatomy, Fakhruddin Ali Ahmed Medical College, Barpeta.

ABSTRACT

BACKGROUND AND AIMS

The "fallopian tubes" (oviducts or uterine tubes) are long paired flexuous reproductive organ which transports ova, spermatozoa, zygotes, the pre-implantation morulae and blastocyst. It has major role during reproductive period, but it remains as if vestigial organ before puberty and after menopause. Due to increasing rate of tubal block and infertility, oviducts and their structures gaining importance and have become a subject of research in present days particularly epithelium. The aim of the study is to ascertain any histological difference of tubal epithelium in different age groups and the research work could be utilized for investigation and management of infertility.

MATERIALS AND METHODS

Seven samples of each group i.e., prereproductive, reproductive & postmenopausal were collected from fresh unembalmed human cadavers received in the department of Anatomy, FAA Medical College, Barpeta, Assam. The slides were prepared using the standard laboratory procedure. Under low and high power objectives the type of cells were observed and epithelial height was measured in the different segments. Stress was given for any significant difference of epithelial height between the different age groups.

RESULTS

Study revealed that among the groups within the same segment, epithelial height was recorded highest (33.57µm) in reproductive group as against the lowest (22.91µm) in post-menopausal group. Epithelial structures of the prereproductive and reproductive groups were significantly differed ($p<0.01$) from the postmenopausal group.

CONCLUSIONS

From the findings of the present study it can be concluded that: 1. In all the groups fallopian tubal epithelium is of simple columnar type and contains three types of cells. Cells are ciliated, secretory & peg (intercalary) cells. 2. In all the groups same type of increasing trend of epithelial height from intramural segment to ampullary segment was recorded. 3. In intergroup comparison of epithelial height in the same segment prereproductive and reproductive groups were significantly differed ($p< 0.01$) from the postmenopausal group.

KEYWORDS

Epithelium, Prereproductive, Reproductive, Postmenopausal, Infertility.

HOW TO CITE THIS ARTICLE: Devi J, Medhi T. Studies on human fallopian tubal epithelium in different age groups. J. Evid. Based Med. Healthc. 2016; 3(12), 388-393. DOI: 10.18410/jebmh/2016/91

INTRODUCTION: Fallopian tubes are one of the unique female reproductive organs with long flexuous structures, extending bilaterally from the uterus in the upper margin of the broad ligament of the uterus. Beginning with the ovarian end each tube is divisible into four segments viz. infundibulum, ampulla, isthmus and intramural. Ampullary region is the normal site of implantation.[1]

Based on the anatomical observations of Herophilus, the Alexandrian anatomist of third century B.C., Rufus the Greek anatomist and physician first described the human oviduct as "antennae or octopus like arms extending as prolongation from each side of the uterus".[2]

Submission 12-01-2016, Peer Review 23-01-2016,
Acceptance 02-02-2016, Published 11-02-2016.
Corresponding Author:
Dr. Jayasri Devi,
Professor & HOD, Department of Anatomy,
Fakhruddin Ali Ahmed Medical College, Barpeta.
E-mail: jd2465@ymail.com
DOI: 10.18410/jebmh/2016/91

But till sixteenth century the existence and anatomical relations of the oviducts were not clear. Gabriele Fallopius in his publication of "Observations Anatomicae"[3] illustrated the oviducts in a better way, and the term 'fallopian' derived from his name. Due to the increasing rate of infertility, the reproductive organs and their functions gaining importance and have become the subject of research in the present era. Studies on fallopian tubal epithelium in respect to different age groups have been reported by different workers.[4,5] The Present study was carried out to observe solely the epithelial architectures of the human fallopian tube and their interrelationship with respect to different ages which may carry important implications both for the prevention and facilitation of conception as well as treatment of infertility and postmenopausal diseases.

HISTOLOGY OF HUMAN FALLOPIAN TUBE: The wall of the fallopian tube is consists of- outer serous coat, middle muscular coat and inner mucous coat. Outer serous coat is

formed by a single layer of flattened cells. Middle muscular coat consists of smooth muscle fibres arranged into a outer longitudinal and a thicker inner circular layer. Intramural part contains another additional innermost longitudinal muscle layer.

Inner mucous coat or mucous membrane consists of an epithelium and a lamina propria connected together by a basal lamina. The mucous membrane is thrown into numerous folds obliterating most of the part of the lumen. The folds show branching but there is no anastomosis. The epithelium is of simple columnar type and contains three types of cells.[6] Cells are ciliated, secretory & peg cells (intercalary) cells.

MATERIALS AND METHODS: Samples were collected from fresh unembalmed human cadavers received in the department of Anatomy, FAA Medical College, Barpeta, Assam. The specimens of the fallopian tubes were divided into three groups according to the different ages as shown below:

Groups	Ages (Years)	Number of specimens
Group-I (Pre reproductive)	0 to 13	7
Group-II (Reproductive)	14 to 49	7
Group-III (Postmenopausal)	50 & above	7

Seven tubes were collected from each group and each tube was complete with intramural, isthmus, ampulla and infundibulum segment and from each segment approximately 3 to 5mm pieces were made and fixed in 10% formol saline and labelled separately. The fixed tissues were processed for embedding in paraffin and sectioned at 5μm thickness. Sections were stained with routine Haematoxylin and Eosin method.

Stained slides were studied under both low and high power objectives. Different type of cells were observed. Epithelial height was measured with the help of an "Spencer ocular" lens and objective micrometre scale at 400 X magnifications.

Calculation of micrometry scale:

15 divisions of ocular micrometre=5 divisions of objective micrometre.

Therefore, 1 division of ocular scale=5/15 divisions of objective micrometre.

As 1 division of objective micrometre=0.01mm.

Hence, 5/15 divisions=5/15 × 0.01mm= 0.003mm= 3.33μm (10^{-3}=1 micron).

Therefore, 1 division of ocular micrometre scale=3.33μm.

Statistical Analysis: The data on epithelial height (μm) were analysed by standard statistical methods[7]. The data were analysed to calculate the Mean±SD and 't' test was applied to find out the statistical differences between the mean values.

RESULTS AND OBSRVATIONS: In all the segments of the fallopian tubes of the Group I and II, epithelium consists of three different type of cells viz, columnar ciliated (c in Fig. 8), non-ciliated secretory (s in Fig. 8) peg or intercalary cells (p in Fig.8). The ciliated columnar cells were seen to have large rounded nuclei whereas non-ciliated secretory cells showed oval to elongated nuclei. The peg cells were situated near the basement membrane and contained oval nuclei. Among all the cells, non-ciliated cells were predominant in the intramural and isthmus but ciliated cells were predominant in the ampulla (Fig. 8) and infundibulum. In Group III oviductal epithelium of early postmenopausal cases exhibited similar findings with that of the Group I and II. But in late postmenopausal cases different type of cells were indistinguishable (Fig. 7) and absence of cilia from the cells and overall epithelium showed atrophy in all the segments.

In all the groups, in all the segments epithelial eight were recorded as shown in the Table 1. From the Table 2 it was noted that the average epithelial height in Group I, II & III at intramural segment as 28.43μm, 28.64μm and 14.74μm respectively, at isthmus as 29.6μm, 29.78μm and 17.93μm respectively, at ampulla as 33.26μm, 33.57μm and 22.91μm respectively and at infundibulum as 31.70μm, 32.08μm and 22.68μm respectively.

In reproductive age group the average recorded epithelial height was highest (33.57) in all the segments whereas least height (22.91) was recorded in postmenopausal group (Table 2). Again it is evident from the Table 3 that there was no significant difference of epithelial height of same segment of the uterine tubes between Group I & II (Table 3) on the other hand differences are highly significant between Group II & III (Table 4) as well as Group I & III (Table 5). But same type of increasing trend of epithelial height (Table 2 & Fig. 1) from intramural to ampullary segment was observed in all the groups.

Group	Number of specimen	Segments of fallopian tube			
		Intramural	Isthmus	Ampulla	Infundibulum
Prereproductive (Group I)	1	28.00	29.00	33.12	31.00
	2	28.21	29.40	33.01	31.80
	3	28.00	29.50	33.80	32.00
	4	98.28	29.90	33.00	31.11
	5	29.00	29.80	33.60	32.00
	6	28.45	30.00	33.80	31.90
	7	28.50	29.60	33.50	32.10
Average		28.43	29.60	33.26	31.70

Reproductive (Group II)	1	28.50	29.50	33.50	32.00
	2	28.60	29.90	33.01	32.10
	3	28.00	29. 50	33.00	32.00
	4	29.00	30.00	33.00	32.00
	5	29.00	30.00	34.00	32.30
	6	28.90	30.00	35.00	31.90
	7	28.50	29.60	33.50	32.30
Average		28.60	29.78	33.57	32.08
Postmenopausal (Group III)	1	14.99	18.00	22.97	22.87
	2	15.00	17.98	22.85	22.92
	3	14.56	18.08	22.83	22.72
	4	14.22	17.77	22.92	22.71
	5	14.68	17.85	22.93	22.61
	6	14.76	18.03	22.95	22.53
	7	14.01	17.87	22.97	22.44
Average		14.74	17.93	22.91	22.68

Table 1: Epithelial height (in μm) in Pre-reproductive, Reproductive and Postmenopausal age groups

Group	Segments of fallopian tube			
	Intramural	Isthmus	Ampulla	Infundibulum
Group: I	28.43	29.60	33.26	31.70
Group: II	28-64	29.78	33.57	32.08
Group: III	14.74	17.93	22.91	22.68

Table 2: Average epithelial height (μm) of fallopian tube in different groups

Group I-Prereproductive.
Group II-Reproductive.
Group III-Postmenopausal.

Group	Segments of fallopian tube			
	Intramural	Isthmus	Ampulla	Infundibulum
Group I	28.43	29.60	33.26	31.70
Group II	28.64	29.78	33.57	32.08
SE ±	0.0977	0.3542	0.1619	0.1298
Value of 't'	2.0460NS	0.5363NS	1.8535 NS	2.0796 NS

Table 3: Comparison of average epithelial height (in μm) in Pre-reproductive (Group I) and Reproductive (Group II) age groups

Group I-Prereproductive, Group II-Reproductive.
NS=Non-significant.

Group	Segments of fallopian tube			
	Intramural	Isthmus	Ampulla	Infundibulum
Group II	28.64	29.78	33.57	32.08
Group III	14.74	17.93	22.91	22.68
SE ±	0.1969	0.1120	0.2655	0.1029
Value of 't'	70.508**	105.739**	140.00**	91.399**

Table 4: Comparison of average epithelial height (in μm) in Reproductive (Group I) and Postmenopausal (Group II) age groups

Group II- Reproductive, Group III- Postmenopausal
** Significant at P < 0.0

Group	Segments of fallopian tube			
	Intramural	Isthmus	Ampulla	Infundibulum
Group I	28.43	29.60	33.26	31.70
Group III	14.74	17.93	22.91	22.68
SE ±	0.2359	0.1489	0.1270	0.2166
Value of 't'	58.068**	78.384**	81.370**	41.641**

Table 5: Comparison of average epithelial height (in μm) in Prereproductive (Group I) and Postmenopausal (Group III) age groups

Group I- Prereproductive, Group III- Postmenopausal
** Significant at P <0.0.

DISCUSSION: It is evident from Fig.8. That in all the groups except late postmenopausal cases of Group III fallopian tubal epithelium consisted of columnar ciliated, non-ciliated (secretory) and peg (intercalary) cells and similar type of observations were also cited by some workers.[5,8] But in senile cases different type of cells were indistinguishable and they appeared flat and atrophied (Fig. 7). These type of observations were also corroborated with some workers.[4,9]

With regard to the epithelial height it is obvious from the Table 1 and Fig. 1. That in all the groups within the same uterine tube, epithelium height was maximum in ampullary segment whereas least height was noted in the intramural segment. These observations were also accorded with some workers.[10,11] Maximum epithelial height of ampulla may be explained in the light that ampulla is the normal site of fertilization.

In intergroup comparison of epithelial height of the same segment (ampulla) of the oviduct (Table 2 and Fig. 1), it is noted that the height was maximum (33.57μm) in reproductive group on the contrary, minimum height (22.91μm) was recorded in postmenopausal group. Significant differences of epithelial height were observed between reproductive and postmenopausal group (Table 4) as well as prereproductive and postmenopausal group (Table 5). But differences between prereproductive and reproductive ages were found to be non-significant (Table 3). These differences in epithelial height among the different groups might be due to the fact that the oviductal epithelium is very refractory to the level of hormones[12,13] (oestrogen

and progesterone) in the plasma. Hence, maximum epithelial height of reproductive group suggested the high level of oestrogen and progesterone in the plasma whereas, atrophied epithelium in senile women (Fig. 7) indicated the low oestrogen and progesterone level in the plasma. These findings were suggested by many workers.[8,14]

CONCLUSION: The present study has highlighted the significant differences of fallopian tubal epithelial height between postmenopausal age group with that of the prereproductive and reproductive age groups. As infertility is one of the major subject of research in the present days, tubal involvement being a common cause, the present study on fallopian tubal epithelium may open scope for the recent technique of treatment like gamete intra fallopian transfer (GIFT) and zygote intra fallopian transfer (ZIFT) for infertility. Further studies with more advanced techniques need to be undertaken to know more about the histological architectures of fallopian tube as well as relations of tubal epithelium with the hormones (oestrogen and progesterone) in different ages. Moreover, the present study has opened scopes for investigation and treatment of infertility cases as well as postmenopausal diseases and there might be scope for future fallopian tube transplant (homogenous) like any other organ of our body.

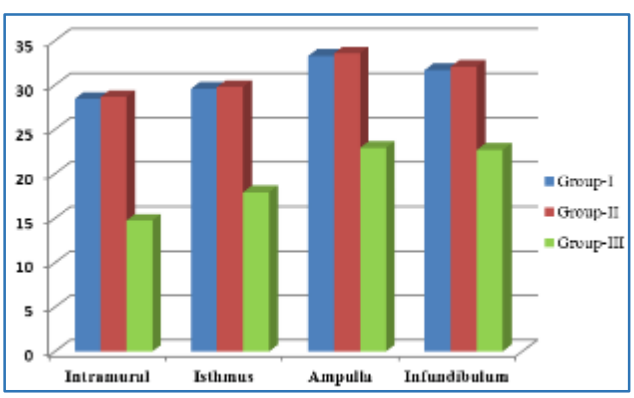


Fig. 1: Average epithelial height (in micron) of fallopian tubes in different groups

Group I-Pre-reproductive, Group II- Reproductive, Group III- Postmenopausal

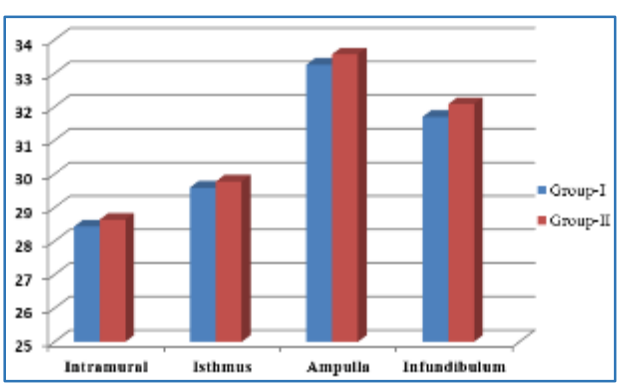


Fig. 2: Average epithelial height (in micron) of fallopian tubes in Pre-reproductive and Reproductive groups

Group I- Prereproductive, Group II- Reproductive

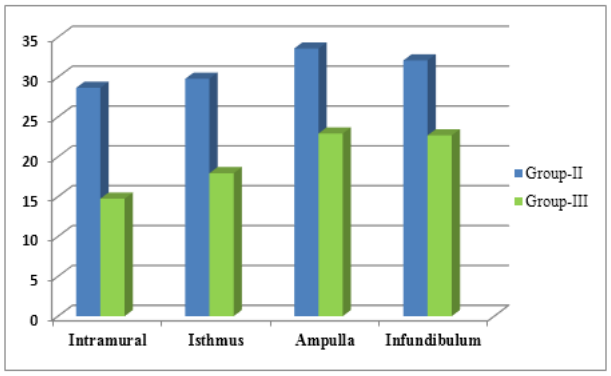


Fig. 3: Average epithelial height (in micron) of fallopian tubes in reproductive and postmenopausal groups

Group II- Reproductive, Group III- Postmenopausal

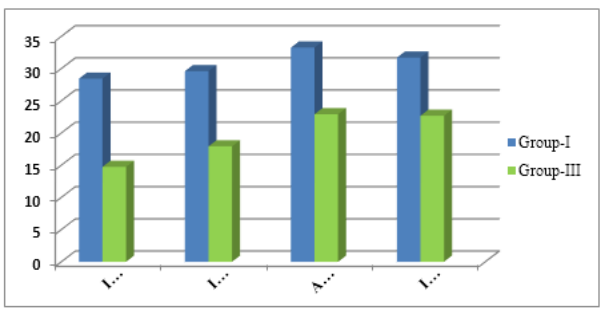


Fig. 4: Average epithelial height (in micron) of fallopian tubes in pre-reproductive and Postmenopausal groups

Group I- Pre-reproductive, Group III- Postmenopausal

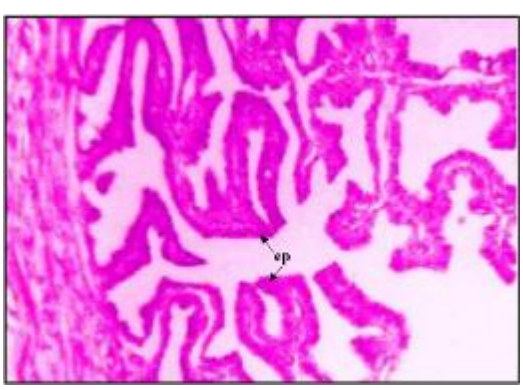


Fig. 5: Photomicrograph of ampulla of Prereproductive fallopian tube showing columnar ciliated epithelium (ep, magnification x 200)

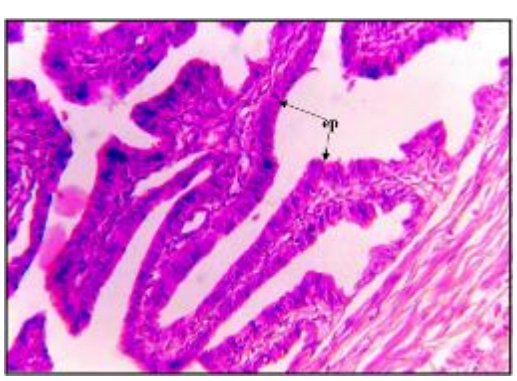


Fig. 6: Photomicrograph of ampulla of Reproductive fallopian tube showing columnar ciliated epithelium (ep, magnification x 200)

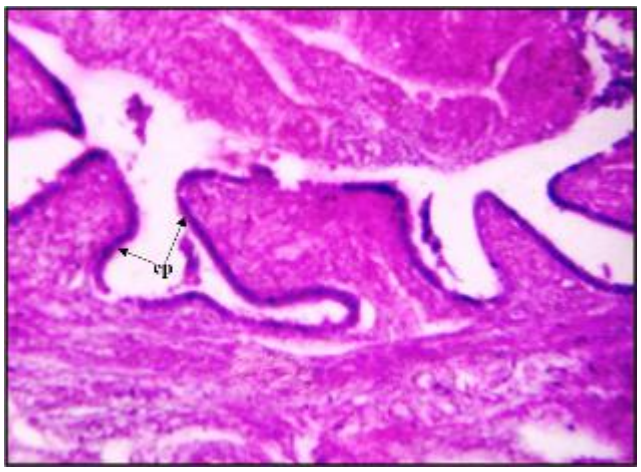


Fig. 7: Photomicrograph of ampulla of Postmenopausal fallopian tube showing Atrophied columnar ciliated epithelium (ep, magnification x 200)

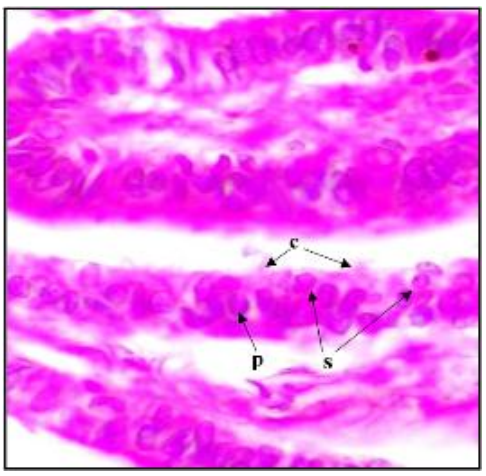
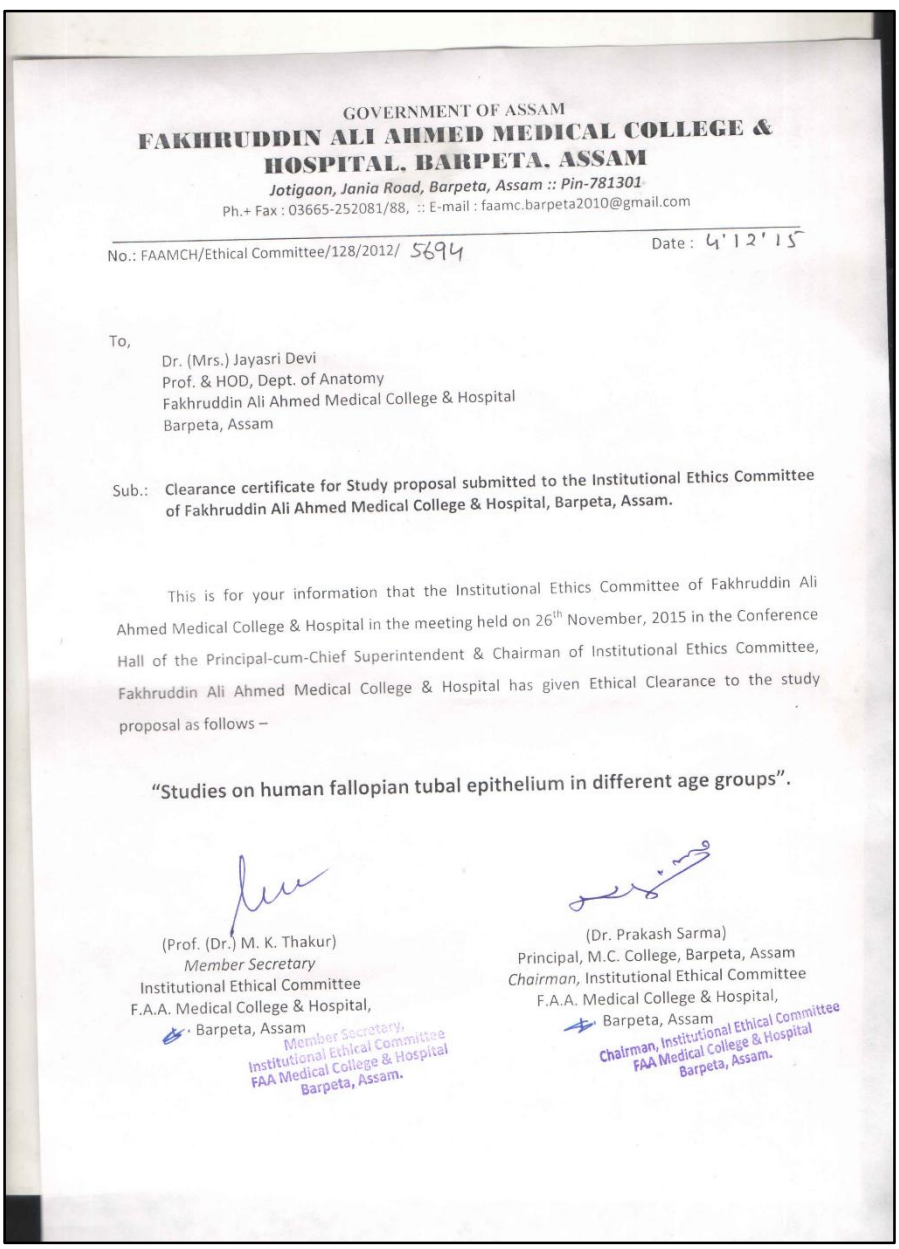


Fig. 8: Photomicrograph of ampulla of Reproductive fallopian tube showing columnar ciliated (c), secretory and peg (p) cells magnification x 400)



GOVERNMENT OF ASSAM

FAKHRUDDIN ALI AHMED MEDICAL COLLEGE & HOSPITAL, BARPETA, ASSAM

Jotigaon, Jania Road, Barpeta, Assam :: Pin-781301

Ph.+ Fax : 03665-252081/88, :: E-mail : faamc.barpeta2010@gmail.com

No.: FAAMCH/Ethical Committee/128/2012/ 5694 Date : 4'12'15

To,

Dr. (Mrs.) Jayasri Devi
Prof. & HOD, Dept. of Anatomy
Fakhruddin Ali Ahmed Medical College & Hospital
Barpeta, Assam

Sub.: **Clearance certificate for Study proposal submitted to the Institutional Ethics Committee of Fakhruddin Ali Ahmed Medical College & Hospital, Barpeta, Assam.**

This is for your information that the Institutional Ethics Committee of Fakhruddin Ali Ahmed Medical College & Hospital in the meeting held on 26th November, 2015 in the Conference Hall of the Principal-cum-Chief Superintendent & Chairman of Institutional Ethics Committee, Fakhruddin Ali Ahmed Medical College & Hospital has given Ethical Clearance to the study proposal as follows –

"Studies on human fallopian tubal epithelium in different age groups".

(Prof. (Dr.) M. K. Thakur)
Member Secretary
Institutional Ethical Committee
F.A.A. Medical College & Hospital,
Barpeta, Assam

Member Secretary,
Institutional Ethical Committee
FAA Medical College & Hospital
Barpeta, Assam.

(Dr. Prakash Sarma)
Principal, M.C. College, Barpeta, Assam
Chairman, Institutional Ethical Committee
F.A.A. Medical College & Hospital,
Barpeta, Assam

Chairman, Institutional Ethical Committee
FAA Medical College & Hospital
Barpeta, Assam.

BIBLIOGRAPHY:

1. Sadler TW. Langman's medical embryology. 2012;12th Ed:P-32.
2. Bodemer CW. History of mammalian oviduct. In: The mammalian oviduct. Hafez ESE and Blandau RJ (eds). The University of Chicago Press. 1969;3-21.
3. Fallopius G. Observationes anatomicae Venice. In: The mammalian oviduct. Hafez ESE and Blandau RJ (eds). The University of Chicago Press. 1561;3-21.
4. Patek E. "The epithelium of the human fallopian tube: A surface ultrastructural and cytochemical study." Thesis submitted to the Swedish Medical research council, Reproductive Endocrinological Research Unit. 1974;53(S31):4-28.
5. Tindal VR. Jeffcoat's principles of gynaecology. Butterworth-Heineman (ed). 1994;5th Ed:30-31.
6. Inderbir Singh. Textbook of human histology. 2011;6th Ed:310.
7. Gupta SP. Statistical methods. Sultan Chand and Sons. New Delhi. 1980;13th Ed:A3.1-3.59.
8. Dawn CS. Text book of gynaecology and contraception. Dawn Books, Calcutta. 1995;12th Ed:32-34.
9. Novak ER, Woodraff JD. Novak's gynaecologic and obstetrics pathology with clinical and endocrine relation. 1979;8th Ed:306-318.
10. Synder FF. Changes in the human oviduct during menstrual cycle and pregnancy. In: Bulletin of John Hopkins Hospital. 1924;141-146.
11. Critoph FN, Dennis KJ. The cellular composition of the human oviduct epithelium. British journal of Obs and Gynae 1977;84:219-21.
12. Goldberg JM, Friedman CI. Effect of hormonal manipulation on human fallopian tube epithelium in vitro. Journal of Assisted Reproduction and Genetics 1995;12(2):132-135.
13. Sawyer HR, Olson PN, Gorell TA. Effects of progesterone on the oviductal epithelium in estrogen-primed prepubertal beagles: light and electron microscopic observations. Am J Anat 1984;169(1):75-87.
14. Kim-Bjorklund T, Landgren BM, Hamberge L, et al. Comparative morphometric study of the endometrium, the fallopian tube, and the corpus luteum during the postovulatory phase in normally menstruating women. Fertil Steril 1991;56:842-850.