Background & objectives: While giving the gross anatomy of the mucosa of the vagina, textbooks of Anatomy and Obstetrics and Gynaecology describe the presence of a median longitudinal ridge on its anterior wall (columna rugarum anterior) and another similar ridge (columna rugarum posterior) on its posterior wall is described, and transverse rugae separated by sulci of variable depth, extend bilaterally from these ridges. While conducting autopsy of female cases the routine examination of vaginal mucosa did not show the presence of longitudinal ridges. In addition, some small areas bearing filiform papillae were seen in the lower third of the vagina in young subjects. As these papillae have not been described earlier, it was decided to study them in detail using scanning electron microscopy.

Methods: A total of 215 vaginal specimens were studied. At autopsy the vagina was slit open on the lateral sides up to the upper ends of the lateral fornices. The anterior vaginal wall was turned up over the uterus and mucosa of both walls examined macroscopically. In 16 subjects, small pieces of vaginal mucosa bearing filiform papillae were cut out and processed for examination under scanning electron microscope (SEM) and a light microscope. In addition, vaginae of 55 married women (20-40 yr age) with complain of lower abdominal pain or infertility were examined particularly for the median longitudinal ridges on the vaginal walls.

Results: At autopsy, the two median longitudinal ridges were not seen in any instance. Small variable areas of the lower third of the vagina showed the presence of filiform papillae on the two walls and at sides; they were prominent in the young individuals and tended to become absent in multipara and in old age. They were 2 to 3 in number on each wall. Histologically the papilla showed a core of highly vascular connective tissue covered by non-keratinized squamous epithelium. Immunoperoxidase staining with S-100 showed a large number of small nerve fibres in the subepithelial tissue which seemed to be more than in the surrounding areas not covered with papillae.

Interpretation & conclusion: Anterior and posterior median longitudinal ridges were not seen on the vaginal mucosa in the autopsy specimens. In all autopsy specimens of young subjects between the ages of 15 and 40 yr, variable areas bearing filiform papillae were observed on the mucosa of the lower third of the vagina. Further studies need to be done to throw light on the role of these papillae.

Key words Filiform papillae - human vagina - ultramicroscopy - vaginal histology
Text books of Anatomy\(^1\) and Obstetrics and Gynaecology\(^2\) usually describe the presence of a median longitudinal ridge on the anterior wall (columna rugarum anterior) and a similar median ridge (columna rugarum posterior) on the posterior wall of the vaginal mucosa. While conducting routine medicolegal postmortem examinations of female subjects, presence of these ridges were not observed which created doubt in our mind. In addition, in young females in the age group of 15-40 yr, the presence of small areas of mucosa were noted showing the presence of filiform papillae which were different from the vaginal papillae in gross appearance. Since these papillae have not been described earlier, it was decided to study their histological structure including appearance under scanning electron microscope (SEM) in a large number of female autopsy subjects.

**Material & Methods**

This study was conducted during 1997-2000 in Postgraduate Institute of Medical Education and Research, Chandigarh, on 215 vaginal specimens (55 of women between 20 and 40 yr, 160 specimens above the age of 15 yr) of non-pregnant women. The vaginal specimens were taken at autopsy with the informed consent of the relatives of the deceased. The vagina showing a gross pathology or subjects where informed consent was not available were excluded from the study. Examination of the specimen was done on spot and later on in the department.

At autopsy, the vagina was slit open on the lateral sides up to upper ends of lateral fornices; the anterior wall of the vagina was turned up over the uterus and mucosa was examined macroscopically. The position of the areas bearing filiform papillae was noted. In six specimens, pieces of papillae bearing areas of the vagina were fixed in glutaraldehyde and processed for scanning electron microscopic examination. After subjecting to critical point dehydration (CPD), mounting on a stub and gold coating was done. Sample was then subjected to visualization under SEM (JSM-6100 model) (in the Department of Central Instrumentation Laboratory, Panjab University, Chandigarh). In 10 instances similar areas of the mucosa bearing papillae were cut out, fixed in 10 per cent formalin and processed for histological examination. Serial sections of 7 μm thickness were cut and stained. Staining methods included haematoxylin and eosin (HE), Masson’s trichrome, van Gieson’s and Verhoff’s. Stained sections were examined under a light microscope. On 10 fresh specimens, immunostaining was done with polyclonal S-100 (Dako, Denmark) as described by Moor\(^3\); Hadji and Morales\(^4\). Endogenous block was applied with 3 per cent H\(_2\)O\(_2\). Sections were incubated with polyclonal anti S-100 (Dako, 1:400 dilution) for one hour. After phosphate buffer saline (PBS) \(pH\) 7.2 wash, sections were incubated with peroxidase conjugated envision (Dako). HE and silver staining for nerves such as Bielschowsky and Hortega were not undertaken as these were cumbersome and many times nerves fibres were not well stained. Apart from examining the areas bearing filiform papillae the mucosa was also specifically looked for the presence of anterior and posterior longitudinal ridges. Attempt was made to quantify the papillae bearing areas and establish their relation with age. The vaginas of 55 consecutive married women (age range 20-40 yr) attending the outpatient department of Obstetrics and Gynaecology, complaining of lower abdominal pain or infertility were specifically examined for the presence of longitudinal ridges. The areas bearing filiform papillae could not be located by per vagina (PV) examination or examination by a speculum.

**Results & Discussion**

Gross examination of the mucous membrane of the anterior and posterior walls of the vagina in autopsy subjects showed the usual papillae caused by transverse ridges and vertical grooves. The vaginal mucosa did not reveal the presence of median longitudinal ridges on the posterior wall or on the upper two-thirds of the anterior wall (Fig. 1). However, on PV examination of patients a median ridge named carina urethralis could be palpated in 16 (29\%) subjects in the lower third or fourth of the anterior wall; in two instances a posterior median ridge was also palpated in the upper third of the posterior vaginal wall. According to De Lancey\(^2\), columna rugarum anterior is caused by the urinary bladder and urethra and the posterior ridge by the rectum. It is difficult to believe that soft, broad
Fig. 1. Anterior wall of the vagina of a 32 yr female as seen from the inner side. Note the transverse rugae dividing the mucosa into numerous quadrilaterals or rounded raised areas. A longitudinal median column is not seen. X 1.

Fig. 2. Right lateral part of the posterior wall of the vagina of a 20 yr female. Arrow indicates the area bearing fine filiform papillae. X 1.

Fig. 3. Low power photomicrograph showing a number of filiform papillae in the lower part of the vagina. Each papilla consists of a core of highly vascularised connective tissue covered with non-keratinized squamous epithelium. Masson’s trichome X 55.

Fig. 4. A photomicrograph of a filiform papilla under greater magnification. The core is composed of subepithelial connective tissue with blood vessels, lymphatics and few lymphomononuclear cells. Masson’s trichome X 140.
structures like urinary bladder and rectum could cause median longitudinal ridges. As the urethra is embedded in the lower third or fourth of the anterior vaginal wall; it may cause the ridge observed by us. The ridge on the upper part of the posterior vaginal wall could be the remnants of the septum between the two paramesonephric ducts.

In addition, the lower one-third or one-fourth of the anterior and posterior vaginal walls showed areas which were studded with small filiform, projections (papillae) to a variable extent (Fig. 2); these papillae were more marked in the mucosa of the posterior wall than on the anterior wall. These papillae could be visualized by naked eye. The numbers of areas bearing filiform papillae, on an average, were two
on the anterior wall and three on the posterior wall. They were irregular in size, and had the maximum length of 5 mm and breadth 4 mm. They could not be seen in the living women by PV and examination by a speculum, as mucosa could not be stretched enough to reveal them. These papillae were, in no way, related to the usual vaginal papillae which tend to disappear on stretching the mucosa. The filiform papillae were prominent in the vagina of the virgins and nullipara and tended to become less marked and even disappear in multipara and in old age. They were not seen in elderly women.

Microscopically, the papillae were filiform projections, the core of which were composed of vascularised connective tissue containing collagen fibres, lymphatics and a few mononuclear cells, and were covered with non-keratinized squamous epithelium (Figs 3, 4). The epithelium overlying a papilla was generally thinner than the surrounding epithelium. Elastic fibres did not show any increase in the papilla or at its base when compared to areas which did not bear the papillae.

Immunoperoxidase staining with S-100, showed numerous small nerve fibres in the stroma of the papillae (Fig. 5). On examining the bases of the papillae and the areas in between, it was noticed that number of fibres was more under the papillae than in between. No quantification of the nerve fibres was undertaken. Nerve bundles were seen in the deeper tissue.

Fig. 7. Scanning electron micrograph showing a single curved papilla. Margins of the cells of the surface epithelium appear to be wavy. X 4,000.
By PV examination or examination by a speculum none of the 55 women demonstrated the presence of patches of mucosa bearing filiform papillae.

Scanning electron microscopy showed multiple filiform or rounded projections 25-50 µm to 2 mm in length and up to 2 mm in breadth at base. The surface of the papilla showed wavy appearance similar to that seen in the surrounding mucosa. Most of the papillae were straight (Fig. 6) but some were curved (Fig. 7).

The papillae, which were prominent in the young subjects, seem to increase friction. This requires further study.

References

Reprint requests: Dr Indar Jit, Emeritus Professor of Anatomy & Forensic Medicine
Post Graduate Institute of Medical Education & Research, Chandigarh 160012, India
e-mail: medinst@pgi.chd.nic.in