CHAPTER 8.

Colposcopic appearance of the normal cervix

The anatomy of the cervix has been outlined in Chapter 2. The colposcopic appearances of normal squamous epithelium, columnar epithelium, the SCJ, immature and mature metaplasia, and the congenital TZ are described in this chapter. An awareness of and the ability to identify the colposcopic features of the normal cervix provide the basis for recognizing abnormal cervical epithelium.

The most important anatomical entity in colposcopy is the TZ. This anatomical zone is where CIN and invasive cervical carcinoma arise.

An examination is *adequate* if it is possible to examine the entire TZ without it being obscured by inflammation, atrophy, bleeding, scarring, or other problems.

The TZ is categorized according to the site, size, and visibility of the TZ (Annex 1).

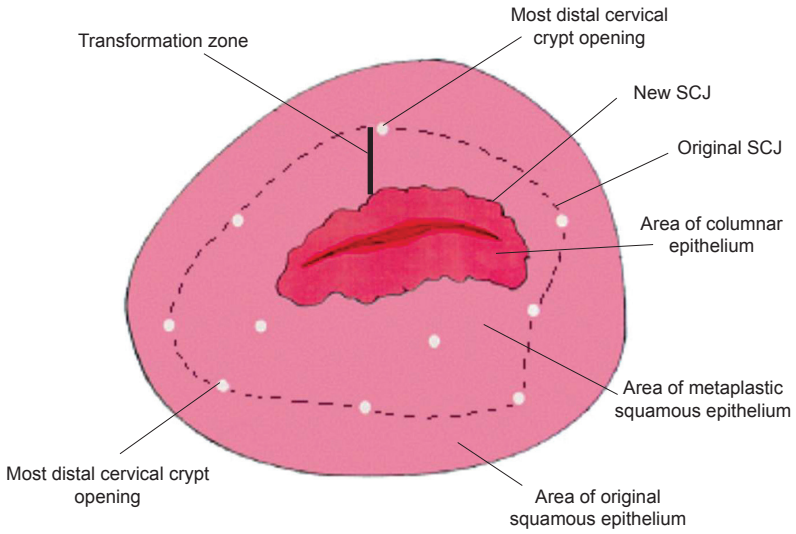
Because CIN and squamous cervical cancer always derive from the TZ, it is essential that the entire TZ can be visualized for the colposcopist to be able to recognize or rule out disease. The ectocervical part of the TZ is very rarely inaccessible, but the upper limit of the TZ may be partially or wholly endocervical, and it may be partially or fully visible to the examining colposcopist. Even though no abnormal findings may be evident in the visible, ectocervical part of the TZ, the presence of cervical neoplasia in the hidden, endocervical component cannot be ruled out.

8.1 After application of normal saline solution

8.1.1 Squamous epithelium

Squamous epithelium is pink, partially translucent, and smooth. The original squamous epithelium may appear slightly darker pink compared with the lighter shade of the metaplastic squamous epithelium of the TZ. If one looks closely, it is apparent in some women that a few crypt openings, which look like tiny circular holes, are scattered over the surface of the squamous epithelium of the TZ (Figs. 8.1 and 8.2). When these are occluded, they become nabothian follicles. Looking distally, away from the os towards the outer part of the ectocervix, one comes to a point where no more crypt openings and/or nabothian follicles are apparent. An imaginary line drawn connecting the most distal of these defines the original SCJ (the junction between the original or native squamous epithelium and the metaplastic squamous epithelium). The original SCJ forms the outer, distal, or caudal border of the TZ through its entire

Fig. 8.1. Illustration of the outer limit of the transformation zone. SCJ, squamocolumnar junction.



360° circumference. Sometimes, it is the subtle colour variation between the native and metaplastic or dysplastic squamous epithelium that defines the original SCJ. Unfortunately, this method is not foolproof. Lugol's iodine is also an unreliable test of the outer limit of the TZ, because the metaplastic epithelium covering the TZ may be more or less mature and therefore strongly or weakly positive. Finally, glands underneath the apparent outer reaches of the TZ may travel distally underneath the surface epithelium, and these glands are, of course, part of the TZ epithelium.

The next task is to identify the proximal or inner border of the TZ, which defines the new SCJ, which is the line of demarcation between the metaplastic squamous epithelium of the TZ and the native and untransformed columnar epithelium above the TZ (Figs. 8.2 and 8.3a). Where the new SCJ is situated and whether it is fully visible will determine the TZ type. The new SCJ tends to recede towards, and eventually into, the endocervical canal as a woman ages, most particularly after menopause (Fig. 8.3b). It is often possible to visualize the new SCJ, by the gentle use of an endocervical forceps such as the Desjardins or the Kurihara forceps (Fig. 5.12). If the SCJ is situated in the endocervical canal more than 10 mm from the external os, it may not be visible even with the aid of endocervical forceps. Also, when the speculum is properly and comfortably positioned, the cervico-uterine axis straightens and the cervix tends to come in line with the colposcopic view. Manipulation with endocervical forceps is then much easier. The vast majority of CIN lesions occur in the TZ, and the most severe changes tend to be closer to or abutting the new SCJ.

8.1.2 Columnar epithelium

In most young women, the new SCJ will be located at or close to the cervical os (Figs. 8.2 and 8.3a). The columnar epithelium, surrounded by the new SCJ, may appear at first glance to be "an erosion", which of course it is not. An erosion implies denuded epithelium, and erosions do often

Fig. 8.2. A series of images of a normal cervix at increasing magnifications. The patient was in early reproductive life and mid-cycle. The cervix is well estrogenized, and normal columnar epithelium is clearly seen through abundant clear mucus. The last image is after the application of Lugol's iodine. The outer limit of the transformation zone does not coincide with iodine positivity, because much of the transformation zone is often covered by relatively mature squamous epithelium, as in this case.

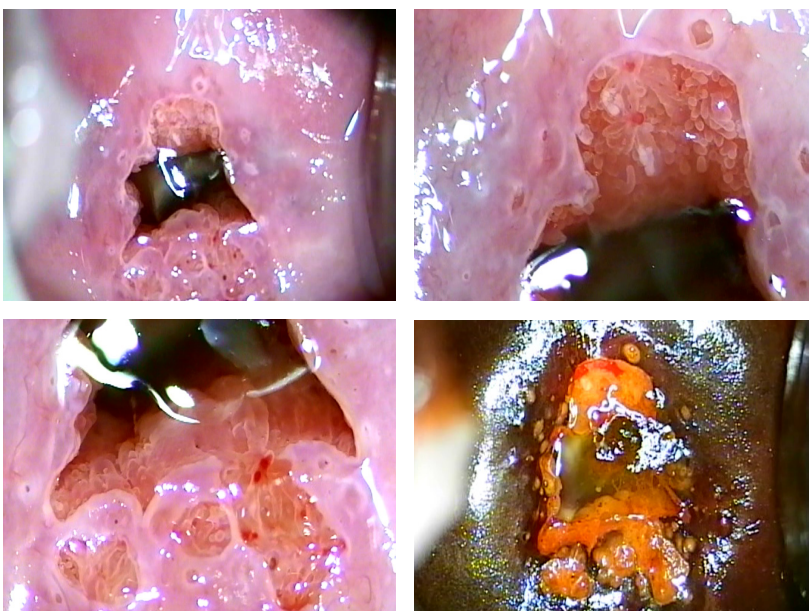
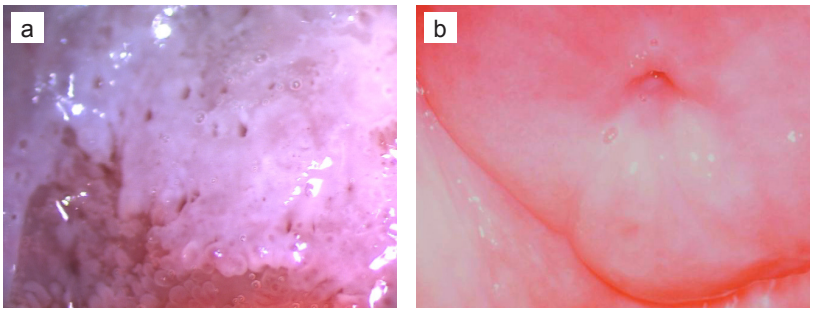


Fig. 8.3. (a) Squamocolumnar junction; clear demarcation between normal columnar epithelium and transformation zone epithelium. (b) The squamocolumnar junction is not visible here, in a postmenopausal woman. It is in the endocervical canal.



look red. Normal columnar epithelium is single-layered and therefore looks redder than the surrounding pinkish squamous epithelium. The columnar epithelium is thrown into crypts or folds, which often produce a grape-like or villous appearance, in contrast to the smooth, light pink squamous epithelium, which is multilayered and does not allow the stromal redness to penetrate as easily. Each columnar villous structure contains a fine capillary (Fig. 8.4), and the blood in the capillary and the vascularity of the underlying connective tissue give the columnar epithelium its strikingly dark reddish appearance. Small polyps may be detected during examination of the endocervical canal.

8.1.3 Vasculature

If a green or blue filter is used after cleaning away mucus with saline, the vasculature will be easier to see. These filters remove the background redness, thereby enhancing the image of the vessels, which will appear to be black. Using higher-power magnification (about 10×) is also helpful. Depending on the thickness or opacity of the overlying squamous epithelium, smaller vessels may or may not be visible. The smaller vessels that may be visible are capillaries that are in the stroma below the epithelium.

Two types of capillaries are apparent in or underneath the native or original squamous epithelium: reticular (network) or hairpin-shaped capillaries (Fig. 8.5). The reticular pattern is especially visible because the epithelium is thinner, for example in women using oral contraceptives and in postmenopausal women. The hairpin capillaries actually ascend vertically, loop over, and then descend back into the stroma where they came from. Because these loops are seen end-on, the colposcopic view usually is of dots with only a slight, if any, appearance of a loop at each. Inflammation of the cervix (e.g. trichomoniasis) often causes hairpin vessels to form staghorn-like shapes, so that the vessels become more prominent and the loop appearance is more apparent. Often, no vascular pattern is seen in or through the original squamous epithelium.

The appearances of ectocervical vessels described above are more prominent towards the outer TZ, closer to the original SCJ. In the more recently formed immature metaplastic squamous epithelium closer to the new SCJ, other vascular patterns become more prominent. These are large (compared with capillaries) branching surface vessels with three recognizable basic patterns (Fig. 8.5). The first pattern is much like a tree branching, and the second is commonly seen overlying nabothian cysts (Figs. 8.5 and 8.6). The regular structure and branching of the blood vessels suggest a benign (normal) nature. A third pattern sometimes occurs when healing has taken place after therapy for CIN, when the vessels are long and run parallel to one another.

The vessels in the columnar epithelium are actually terminal capillary networks. One capillary network is confined to the stromal core of each grape-like villus (Fig. 8.4), which projects up to the epithelial surface. With the colposcope, the rounded tips of the individual villi are the main features seen, and the top of the vessel network in each villus appears as a dot. Large, deep branching vessels may be seen in some cases.

Fig. 8.4. Diagrammatic representation of the capillary network projecting up into a columnar villus.

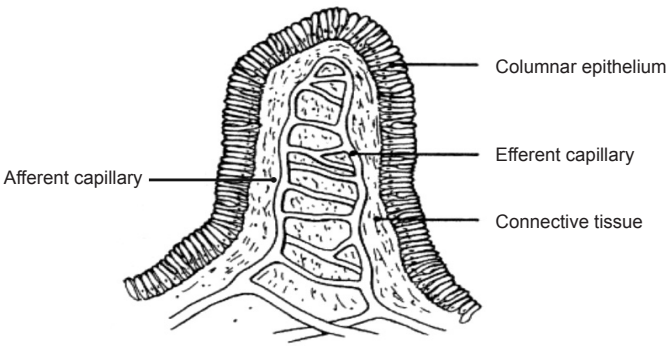
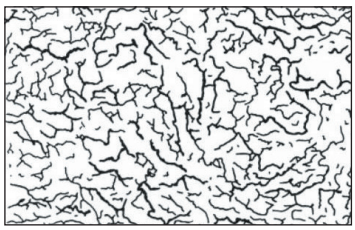
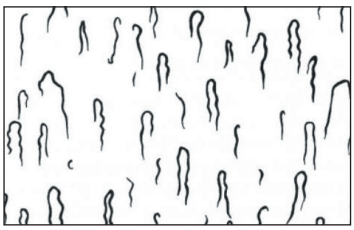


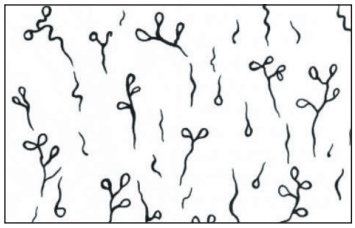
Fig. 8.5. Normal blood vessel patterns seen with a colposcope, usually best seen at 10× to 15× magnification.



Network capillaries



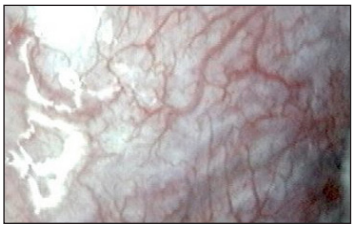
Hairpin capillaries



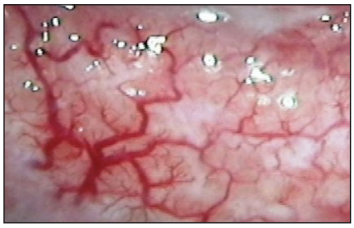
Staghorn-like vessels

Long, parallel blood vessels

Regular vascular network



Long, regular branching vascular tree with gradual decrease in calibre



Blood vessels showing regular branching

8.2 After application of 5% acetic acid

8.2.1 Squamous epithelium

A minute or so after acetic acid has been applied and has taken effect, well-estrogenized squamous epithelium will appear to be a little duller and paler. Sometimes the SCJ will be prominently visible as a sharp, step-like white line, because of the presence of actively dividing immature squamous metaplasia around the edge, medial (proximal) to the junction (Fig. 8.3a).

Postmenopausal squamous epithelium is variably atrophic and looks paler, brittle, without lustre, and sometimes with subepithelial petechiae due to subepithelial capillaries from the slightest trauma to the epithelium, even the insertion of the vaginal speculum. The new SCJ may not be visible in postmenopausal women, because it has usually receded into the endocervical canal (Fig. 8.3b).

8.2.2 Columnar epithelium

Columnar epithelium is usually noticeably less dark red after acetic acid has been applied than it was with saline application, and the pale aceto-whitening of the villi may resemble a grape-like appearance (Figs. 8.2 and 8.3a). After the endocervical mucus among the villi has been coagulated by the acetic acid and wiped away, the topography may be seen more easily. In pregnant women, the villi are hypertrophied and the grape-like appearance is easier to observe.

8.2.3 Squamous metaplasia

During the different stages of the development of metaplasia, a range of colposcopic appearances may be seen. This can present a challenge to an inexperienced colposcopist,

Fig. 8.6. Normal branching vessels (labelled a) stretched over a nabothian follicle.

but in truth it does not usually affect management. The differences between normal, metaplastic, and low-grade squamous lesions are not reliably recognizable colposcopically and are not important clinically. Women should be treated if they have evidence of HSILs that are truly precancerous (HSIL-IN3) – this is when a transforming infection has taken place – and not when there is a LSIL or squamous metaplasia (see Chapters 4 and 11).

The development of squamous metaplasia may be recognized colposcopically (Jordan and Singer, 2006). In the earliest stage, the translucence of the columnar epithelial villi is lost and the villi become opaque at their tips; the villi widen and flatten, and successive villi fuse into clusters and sheets with a pale pink colour. Consequently, the metaplastic epithelium looks like a patchily distributed pale cluster, or sheet-like area, in the ectopic columnar epithelium (Fig. 8.7a).

As the metaplasia progresses, the grape-like configuration of the columnar epithelium disappears (Fig. 8.7b) and the spaces between the villi are fused with glassy, pinkish-white finger- or tongue-like membranes pointing towards the external os (Fig. 8.7c). There may be numerous crypt openings and islands of columnar epithelium scattered throughout the metaplastic epithelium. The rims of the crypt openings may not turn white with acetic acid early in the process of metaplasia, but may turn mildly white as the metaplastic process progresses. Gradually, the tongue-like metaplastic areas fuse together to form a continuously advancing glassy, shining, pinkish-white, or mildly pale epithelial area.

8.3 Nabothian follicles

Immature metaplastic epithelium eventually becomes fully developed mature metaplastic squamous epithelium resembling the original native squamous epithelium, except for the presence of some crypts (Fig. 8.3a) or nabothian follicles in the metaplastic epithelium (Fig. 8.6). Nabothian follicles may appear as white, dot-like areas in the beginning, before they enlarge with progressive accumulation of mucus within the follicle, presenting as pimple- or button-like ivory-white or mildly yellowish areas. The typical vessel formations in the metaplastic epithelium include long regular branching vessels with gradually decreasing calibre and a network of regular branching vessels. These vascular patterns may be seen more prominently over the nabothian follicles simply because they have been stretched over the distending surface of the follicle.

8.4 Cervical polyps

Cervical polyps are common and are usually benign. When they are protected in the endocervical canal by endocervical mucus, their

Fig. 8.7. (a) Early immature squamous metaplasia seen after acetic acid application. The tips of the villi are becoming white (labelled a), and some are fusing together (labelled b). (b) Immature squamous metaplasia seen after acetic acid application. Some of the villi have coalesced to form a thin squamous layer (labelled a). In other areas, some villi are beginning to fuse together (labelled b). (c) Immature metaplasia seen after acetic acid application. Peninsulas or tongues of metaplastic epithelium can be seen (labelled a), and some crypt openings are apparent (labels b and c, also arrow).

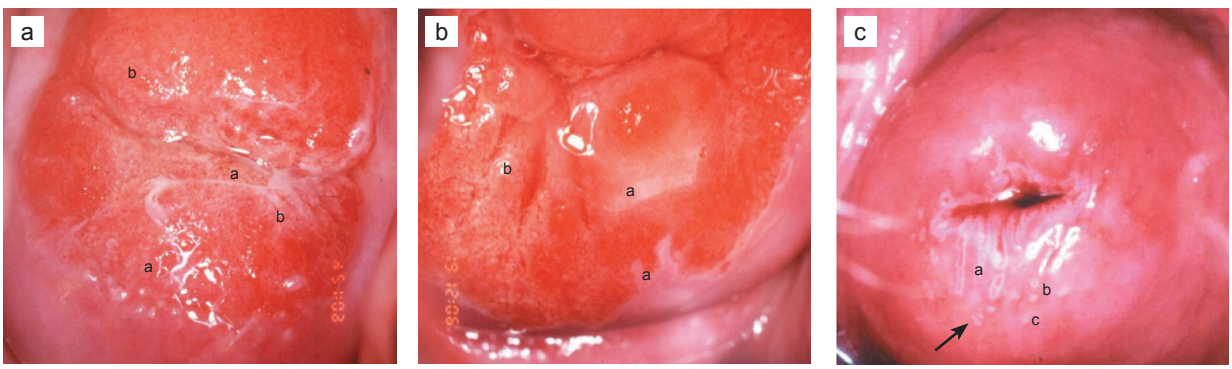
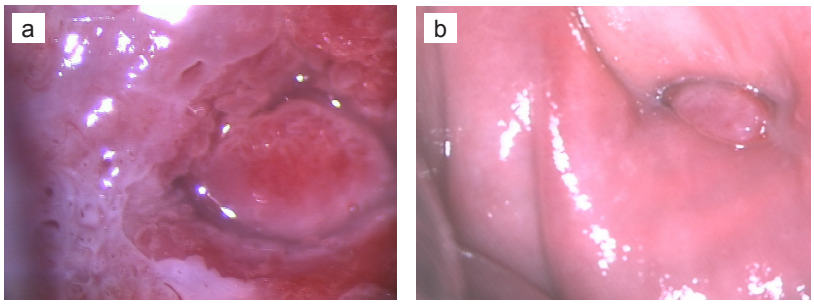


Fig. 8.8. (a) An endocervical polyp protected in the endocervical canal by the canal mucus has not yet undergone metaplasia. (b) A cervical polyp whose tip is permanently exposed to the vaginal environment. The exposed epithelium has undergone metaplasia.



surface epithelium does not metaplase (Fig. 8.8a). When metaplasia occurs in the epithelium covering a protruding cervical polyp, it is covered by pale white epithelium (Fig. 8.8b).

8.5 After application of Lugol's iodine

As described in Chapter 2, glycogenated cells take up iodine; the more mature they are, the more they take up iodine. Fully mature squamous epithelium has a uniform dark mahogany brown colour when stained with Lugol's iodine. Therefore, well-estrogenized squamous epithelium, whether original or mature squamous, will become dark or mahogany brown (Fig. 8.9a). This is sometimes helpful in distinguishing normal areas from abnormal areas in the TZ that were faintly acetowhite, and is one of the indices of normality/abnormality in the Swede score. Columnar epithelium does not stain with iodine. Immature squamous metaplastic epithelium usually does not stain with iodine or may partially stain if it is partially glycogenated (Fig. 8.9b and c). The vascular features, so easily seen with saline, may be difficult to observe after application of iodine.

Cervical polyps do not stain with iodine, because they are usually covered with columnar or immature metaplastic epithelium. If the maturation of the metaplastic epithelium varies, one may observe various fields of no uptake or partial to full iodine uptake on the polyp.

In postmenopausal women, the atrophic ectocervix will not stain fully with iodine.

8.6 Congenital transformation zone

The congenital or original TZ stains faint white after the application of acetic acid. In this condition, the metaplastic epithelium formed during the latter portion of fetal life, lying distal to the TZ formed after birth, is located far out on the ectocervix, some distance from the cervical os, and in some cases may even extend onto the vagina. It is important to recognize this as a normal condition, for which no treatment is necessary. It commonly extends onto the vaginal walls anteriorly and posteriorly, and less so laterally.

With acetic acid, the congenital TZ will usually take on a mild acetowhite stain and the capillary vasculature may have a fine mosaic or punctate pattern. It does not take up iodine after the application of iodine. If a biopsy is taken of the tissue to confirm the diagnosis, it is best to alert the pathologist of the colposcopic impression.

Fig. 8.9. (a) Clear distinction between full uptake of Lugol's iodine in the native squamous epithelium (Schiller test-negative) outside a transformation zone and no uptake in the immature squamous metaplastic epithelium (Schiller test-positive). (b) Immature squamous metaplasia in this normal transformation zone before the application of Lugol's iodine. (c) Minimal patchy uptake of Lugol's iodine in this normal transformation zone with immature squamous metaplasia (labelled a) (same cervix as in part b).

Key points

- Squamous epithelium appears smooth and translucent, with a pinkish tinge.
- The original squamous epithelium, i.e. outside the transformation zone, appears slightly darker pink than the metaplastic epithelium within the transformation zone.
- Columnar epithelium appears darker red, with a grape-like or villous appearance.
- Often no vascular patterns are seen in or through the original squamous epithelium.
- After the application of acetic acid, the transformation zone squamous epithelium appears dull and pale in contrast to the usual pink hue.
- Squamous metaplasia has a range of colposcopic appearances, which cannot be reliably distinguished from low-grade squamous intraepithelial lesion.
- Both the original squamous and the mature squamous metaplastic epithelium of the transformation zone stain mahogany brown with Lugol's iodine (Schiller test-negative).
- Immature squamous metaplastic epithelium will usually partially take up Lugol's iodine.
- Postmenopausal squamous epithelium will not take up Lugol's iodine (Schiller test-positive).