Neoplasia associated with ureterosigmoidostomy is uncommon but important. Two patients, one of whom developed symptoms five years after the ureterosigmoidostomy had been taken down, are reported. The authors support the theory that these tumors may arise from the ureter. When ureterosigmoidostomies are dismantled, the site of implantation should be resected and the patients kept under long-term endoscopic review.

**Key words:** Ureterosigmoidostomy; Polyp formation; Carcinoma of the colon; Colonic polyp; Transitional epithelium; Glandular metaplasia

**Report of Cases**

**Patient 1:** A 34-year-old man with exstrophy of the bladder had undergone ureterosigmoidostomy in the first year of life. In view of the increased incidence of colonic neoplasia associated with ureterosigmoidostomy, he was referred for colonoscopic surveillance.

At the first examination, a 1-cm irregular polyp associated with one of the ureteric orifices was biopsied. The other orifice was not clearly identified. At repeat colonoscopy 10 months later, the polyp was noted to be significantly larger. The lesion was completely removed by diathermy snare. Repeat examinations, 6 and 18 months later, have shown no sign of recurrence.

**Pathology:** The initial biopsy of the lesion consisted of three small fragments of tissue. Microscopy showed them to consist of large-bowel type mucosa with marked nuclear pleomorphism and increased mitotic activity amounting to carcinoma in situ (Fig. 1).

The second specimen from this patient was a lobulated polyp, 1 cm in diameter. Microscopy showed it to be covered by large-bowel mucosa, mainly within normal limits, but with areas of mucin depletion associated with moderate dysplasia.

**Patient 2:** A 38-year-old woman presented with a long history of dysuria, urinary frequency, and urge incontinence. Cystoscopy showed an edematous bladder mucosa, and biopsy revealed squamous metaplasia. Over the next six years, she underwent Helmstein's bladder dilatation twice and diathermy to her bladder base. She was also treated with imipramine and Pro-banthine. These measures did not help, and symptoms persisted and worsened.

She accepted urinary diversion as an alternative to her intractable symptoms and underwent ureterosigmoidostomies with Leadbetter-Charles reimplantations into the sigmoid colon. After this procedure, she was well except for mild diarrhea. Five months later she was found to have an obstructed left ureter and subsequently had the ureterosigmoidostomies taken down without colonic resection and the ureters reimplanted into an ileal conduit. She remained well for five years and then presented with rectal bleeding. Barium enema showed a large polyp in the distal sigmoid colon and a second smaller one at the apex of the sigmoid loop.

At colonoscopy the lower polyp was found to be 3 cm in diameter and lobulated with an irregular surface. It was removed piecemeal. At a repeat examination a few months later the diathermy polypectomy was completed and a second polyp found. This lesion was sessile and bled easily on contact. It was ablated with diathermy and biopsies were taken. The sites of these polyps coincided with those of the previous ureteric implantations.

**Pathology:** The first specimen was a multilobulated polyp, 3 cm in diameter. The cut surface showed multiple small cysts. The micro-
Fig. 1. Histologic appearances in Patient 1. Section showing severe epithelial dysplasia amounting to carcinoma in situ (hematoxylin and eosin; × 315).

scopic appearances were of an inflammatory type polyp with many partly lined mucin lakes lying within the central stoma. There was no dysplasia or sign of malignancy.

The second specimen was a biopsy consisting of three small fragments of tissue. These showed acutely inflamed colonic mucosa and features similar to the previous specimen.

The third specimen from this patient was a 1.4-cm piece of polypoid tissue. Microscopy showed this to consist of granulation tissue with a few distorted colonic glands in the epithelium. The epithelium was acutely inflamed and had distinct areas of squamous metaplasia. There was no evidence of malignancy (Figs. 2 and 3).

Discussion

Neoplasia associated with ureterosigmoidostomy has been recognized for many years. Hammer described the first reported case of colonic carcinoma in 1929 and this tumor has been the most frequently reported. Other lesions have been reported including urothelial carcinoma and various benign polyps described as adenomas, reactive polyps, and juvenile polyps. The incidence of carcinoma complicating ureterosigmoidostomy for benign disease is 6 percent, however this is in a relatively young population with a mean age of 35 years. Polyps have been reported somewhat less frequently, but the incidence probably has been underestimated before the era of fiberoptic endoscopy.

The period of latency between formation of the ureterosigmoidostomy for benign bladder pathology and presentation of a neoplasm varies, with a mean of 25 years. This period of latency is greatly reduced when diversion has been performed for bladder carcinoma.

The presenting clinical features are usually bleeding per rectum or ureteric obstruction. These features are not unusual in patients with ureterosigmoidostomies, but should be regarded with suspicion when they occur late. Many patients are asymptomatic.

There have been several theories proposed for the etiology of these lesions. These include chronic mechanical irritation of a protuberant ureteral stoma by the fecal stream, prolonged contact with urine, urinary carcinogens, and alterations in colonic electrolyte concentrations. Crissey et al. developed a rat model and proposed a combined effect of fecal and urinary carcinogens.

The most commonly held view is that urine acts on colonic mucosa as a carcinogen. The theory that these tumors arise not from the colonic mucosa, but from the ureter has been proposed recently. The theoretical pathogenesis is that the transitional epithelium undergoes glandular metaplasia and subsequent neoplasia as a response to a hostile environment. The evidence for this theory and against a colonic origin is as follows.

If urine were the carcinogen responsible, one would expect to find lesions throughout the colon distal to the ureterosigmoidostomies. Strachan et al. showed that the