

## Vascular Patterns of Villous Tumors of the Colorectum

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In order to more fully understand the morphological characteristics of villous tumors of the colorectum, the vascular patterns of six colorectal resection specimens were microangiographically studied. Grossly, villous adenomas were of two main types: pedunculated polyps and carpet-like lesions. Pedunculated villous adenomas had many large stalk vessels in a broad short pedicle, representing a large blood supply to the tumor. The carpet-like lesions were composed of continuous clusters of polyps with stalk vessels and the flat elevated lesions among polyps and at the periphery showed similar vascular patterns to the mucosa of normal colon. In lesions with cancer invasive to the proper muscle layer, scattered ulcerations due to the destruction of polyps were also observed, corresponding to at least a Duke's B lesion. The above findings could represent very important additional information for endoscopic treatment or local excision for the prevention of hemorrhagic complications or incomplete removal of tumor.

**Key words:** villous tumor of the colorectum, pedunculated polyp, carpet-like lesion, microangiography

### Introduction

Villous tumors of the colorectum are uncommon lesions, occurring in less than 3.5% of adenomatous polyps in Japanese series, although it is not a rare disease in Europe and the United States<sup>1-4)</sup>. They are adenomatous lesions with morphological and biological features; large and sessile, with a shaggy surface composed of numerous fronds, with a higher malignant potential than tubular adenoma<sup>1)5)</sup>. In most cases these lesions are benign or in situ cancer, and have been treated by colonoscopic polypectomy or local excision via laparotomy<sup>6-8)</sup>. However, they are frequently associated with invasive carcinoma

with an incidence of 8.3 to 41%<sup>2-4)9)10)</sup>. Recently, there is a need for a clearer concept of the basic nature of villous tumors in order to obtain a reasonable perspective for dealing with them. Although the vascular system has long been considered to play an important role in the growth and development of cancer, the relation of the vascular pattern to the morphologic changes of villous tumors has been rarely in the literature<sup>11-14)</sup>. In the present study, the vascular patterns were morphologically investigated by microangiography of surgical resection specimens.

### Materials and Methods

#### Patients

The subjects were six patients with colorectal villous tumor, in whom microangiography of the surgically resected specimens was performed at our hospital from 1985 to 1993 (Table 1). The patients consisted of 5 men and one woman with a median age of 54.8 years (range: 40-66). The location of the primary tumors was as follows: descending colon, 1; sigmoid, 2; rectum, 3. The size of tumors ranged from 4.0 to 7.0cm in maximum diameter, with a mean of 5.4cm. One patient had synchronous adenocarcinoma of the colorectum (Case 3).

Macroscopically, 2 villous adenomas were pedunculated polyps with a broad short pedicle (Cases 1 and 2), and 4 were carpet-like growths (Cases 3-6). They were histologically classified as villous adenoma because villous elements accounted for over 70% of the tumor, but they were associated with varying cancerous components; 2 in situ cancers (Cases 1 and 3), 3 invasive submucosal cancers (Cases 2, 4 and 5) and one cancer invasive to the proper muscle layer (pm-cancer) (Case 6).

#### Microangiography

Surgically resected specimens were prepared for

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Table 1. Clinical and Pathological Features of Villous Tumors

Case No.	Age • Sex	Location	Gross form	Size (cm)	Histology • cancer	Depth of cancer
1	55 • F	descending	pedunculated	5×3.5	adenoma • in situ	
2	40 • M	sigmoid	pedunculated	4×3	adenoma • sm	
3	55 • M	sigmoid	carpet-like	6×6	adenoma • in situ	
4	65 • M	rectum	carpet-like	3×4.5	adenoma • sm	
5	48 • M	rectum	carpet-like	6×5	adenoma • sm	
6	66 • M	rectum	carpet-like	5×7	adenoma • sm	

microangiography by the following method. A fine polyethylene catheter was inserted into a main artery supplying the lesion. The preparation was first flushed with physiological saline. The contrast material (Micropaque) was injected under a mean pressure of 150 mmHg. The specimen was fixed in 10% formalin solution for 48 hours, and cut into 2-5 mm sections longitudinally through its middle portion. Microangiography was performed on these sections. All specimens used for microangiography were embedded in paraffin, cut into 4 $\mu$ m sections and stained with hematoxylin and eosin for histologic study. The vascular pattern of the normal colonic wall was classified according to the report of Spjut et al.<sup>10)</sup>, which divides vessels into 5 types in accordance with histological findings of the colonic layers; mucosal vessels, submucosal vessels, muscular vessels with penetrating vessels, subserosal and serosal vessels.

## Results

The pedunculated polyps with a broad short pedicle had many stalk vessels arising from large penetrating vessels and submucosal vessels (Cases 1 and 2) (Fig.1). The stalk vessels showed a radiating course across the central core toward the muscularis mucosae. In muscularis mucosae, the branches freely anastomosed with each other to form a network of channels from which the characteristic tumor vessels arose. The tumor vessels of the villous adenoma consisted of long smaller capillaries running through innumerable lobules of smaller size, corresponding to the papillary projections of the lesion. The vessels in an area of in situ carcinoma maintained the villous vascular patterns (Case 1), but a focal area of invasive carcinoma showed increased vascularity with organized vessels (Case 2) (Fig.2).

The carpet-like tumors exhibited continuous clusters of pedunculated polyps of villous adenoma with a short or long stalk (Cases 3-6) (Fig.3). Stalk vessels were found in each nodule. The flat elevated lesions among polyps and at the periphery showed similar vascular patterns to that of normal colonic mucosa. In Case 6 with pm-cancer, scattered small ulcers were observed in the middle portion of the tumor (Fig.4B). Microangiography demonstrated continuous clusters of pedunculated polyps around the ulcerated area (Fig.4A). In the ulcerated area, the

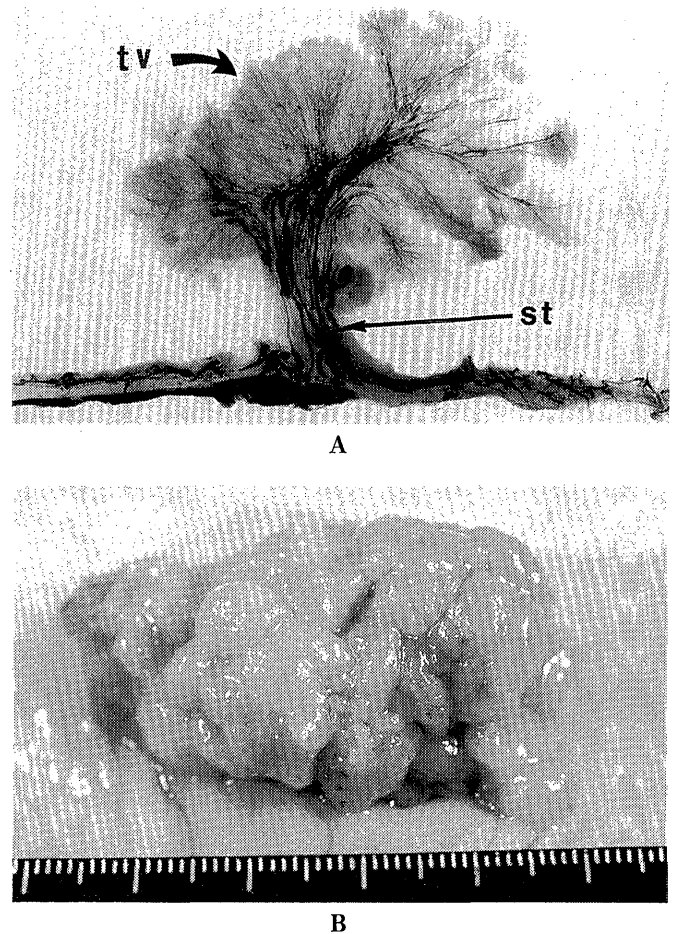
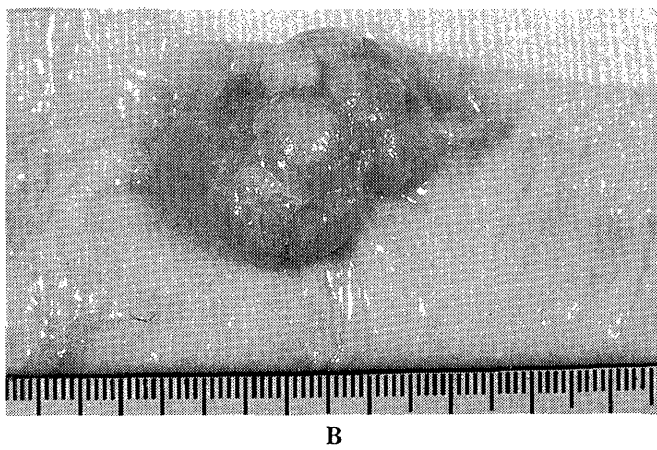
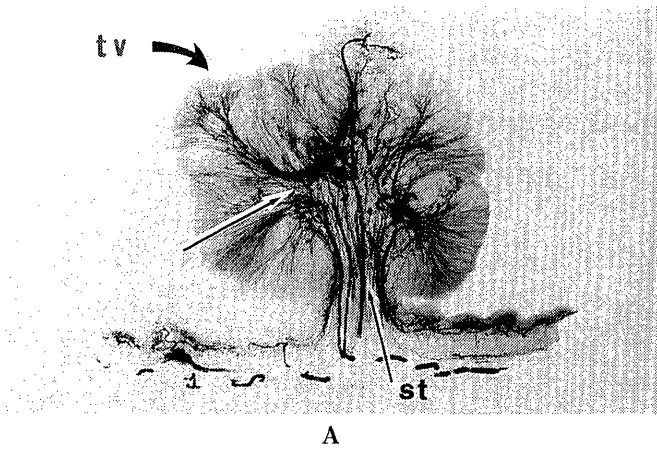


Fig. 1. Pedunculated type of villous adenoma in Case 1. A: microangiography shows many stalk vessels in broad short pedicle. The tumor vessels consists of long smaller capillaries running through innumerable lobules of smaller size. st: stalk vessels, tv: tumor vessels. B: resected specimen. 5 x 3.5cm in size.

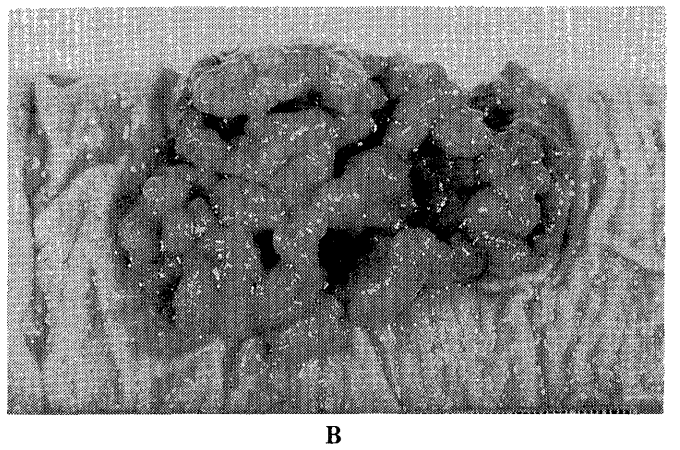
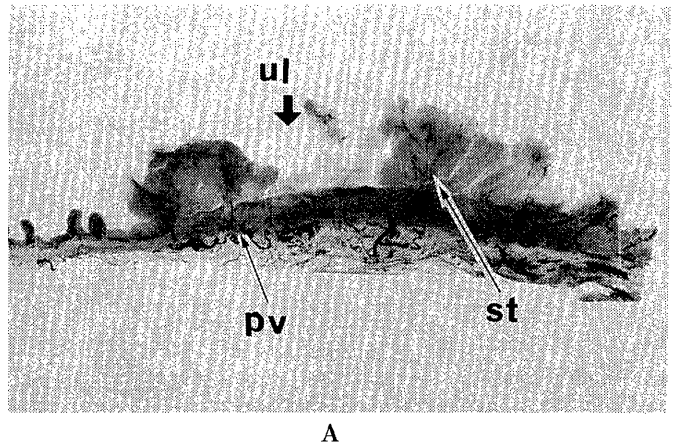
muscular layer maintained a normal vascular pattern although showing dilated penetrating vessels.

## Discussion

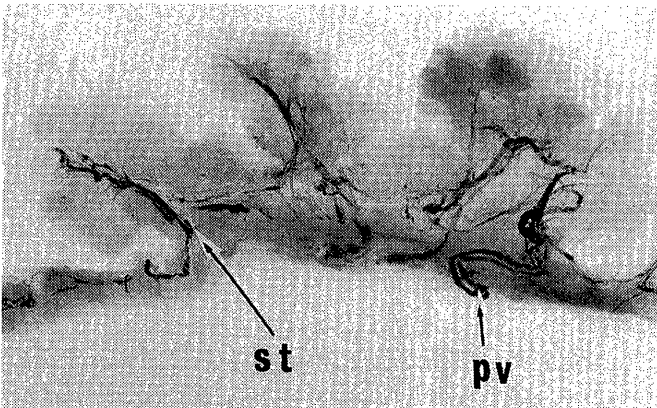
Microangiography of gastrointestinal lesions has long been utilized to study the relationship between the vascular system and morphological or biological behavior of lesions<sup>11-14)</sup>. Detailed descriptions concerning the vascular



**Fig. 2.** Pedunculated type of villous adenoma in Case 2. A: microangiography shows increased vascularity with organized vessels in a focal area of invasive carcinoma (arrow). st: stalk vessels, tv: tumor vessels. B: resected specimen. 4 x 3cm in size.



**Fig. 4.** Carpet-like lesions of villous adenoma in Case 6. A: Microangiography shows clustering polyps around the ulcer. B: Resected specimen shows small ulcers scattered in tumor. ul: ulcer area, pv: penetrating vessels, st: stalk vessels. 5 x 7 cm in size.



**Fig. 3.** Carpet-like lesions of villous adenoma in Case 3 showing continuous clusters of polyps with stalk vessels. pv: penetrating vessels, st: stalk vessels.

pattern of polyps and colorectal cancers have also been published<sup>11,14</sup>, but there have been very few concerning villous adenoma. Spjut et al.<sup>12</sup>, in their microangiographic

study of gastrointestinal lesions, reported that the one villous tumor was not well injected, and in those areas sufficiently visualized for study, no difference could be seen in the vasculature of villous adenoma and adenomatous polyps. On the other hand, we investigated the microangiographic findings of colorectal polyps together with the process of morphogenesis of colorectal cancer, and classified tubular adenomas as having four vascular patterns: pedunculated polyp with long stalk, pedunculated polyp with short stalk, broad-based polyp and sessile polyp<sup>10</sup>. In the present study, tumor vessels of villous adenoma were characteristically longer and slender than those of ordinary tubular adenoma. In general, the vessels were characterized by the stromal structures of the tumor, because the vessels coursed in the stroma. These characteristic tumor vessels appear to reflect certain pathologic features of villous adenoma which implicate the vascular pattern in its morphogenesis: individual villi arising from the muscularis mucosae, growing vertically toward the bowel lumen, and its length being more than 3

times the thickness of the normal mucosa<sup>1)3-5)</sup>.

On the other hand, the gross findings of villous adenomas were classified into two types: pedunculated polyp and carpet-like lesion. Microangiographically, the pedunculated type of villous adenoma had stalk vessels in the pedicle. However, the stalk vessels of villous tumors were more numerous, larger and wider compared to ordinary tubular adenoma. These vascular findings suggest that villous tumors have a large blood supply and can thus grow to reach a large size. Carpet-like lesions are uncommon among villous tumors. Rubesin et al.<sup>15)</sup>, in a radiographic study of 14 carpet lesions of the colon, reported that these lesions were flat, lobulated tumors that spread along the mucosal surface of the colon but showed little protrusion into the lumen, and all were adenoma with varying amounts of villous change. In our series, the vascular pattern of carpet-like lesions showed continuous clusters of polyps having stalk vessels in each pedicle. Clinically, the possibility of massive bleeding from the stalk vessels was considered to be extremely high if these lesions are treated by polypectomy. Vascular growth patterns of carpet-like lesions seem to be characteristic. In the flat lesion at the periphery, the basic vascular pattern of the mucosa was maintained although distorted. This seems to be morphological evidence to indicate that the carpet-like lesion may spread horizontally along the adjacent mucosa. In the middle portion of less advanced tumors, scattered ulceration due to destruction of polyps was observed. From these findings, the individual polyps in carpet-like lesion appeared to each exhibit have different proliferation, and the ulcerations in the lesion might be pathognomonic of invasive malignancy indicating at least a Dukes B lesion which should be managed by colorectal resection.

In conclusion, the present study indicates that these vascular patterns should be kept in mind in the clinical management of villous tumors, particularly in relation to endoscopic polypectomy.

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