

Macroscopic Characteristics of Intestinal Tuberculosis and Their Use for Differential Diagnosis

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Summary. Previous macroscopic classification of intestinal tuberculosis (Tb) have been generally based on its active phase; however, it often shows spontaneous healing as other inflammatory bowel diseases. This study was designed to define the macroscopic features and classification of intestinal Tb in all its stages, making these available for radiological and endoscopic diagnosis as well as for distinction from other inflammatory diseases. Twenty-three definite intestinal Tbs (with acid-fast bacilli and/or caseation granuloma), 13 probable intestinal Tbs, 6 ischemic enterocolitis and 3 radiation-induced enterocolitis were selected from our intestinal file of surgically resected specimens. Specimens from 22 of 36 Tbs and 9 control cases were cut stepwise for detecting granuloma, a form of open and healed ulcers and fibrosis. These were mapped out on color prints with cutting lines on the lesions. Twenty of 23 definite intestinal Tbs (86.9%) had circular open and/or healed ulcerative lesion(s) and the remaining 3 showed a wide circular mucosa-atrophic zone with circular to round ulcer-scars and inflammatory polyps. Sixteen of 23 definite Tbs were associated with round to oval ulcers (open and healed). Definite Tbs could be classified macroscopically into round to oval ulcers and circular ulcer each having open to healed stages and a wide circular mucosa-atrophic type.

The three different lesions with a circular ulcer, wide circular mucosal atrophy or oval ulcer could be distinguished macroscopically from each other in combination with the such findings as the location of ulcer, the most affected side of the mesentery or tenia, depth of the ulcer, features of the ulcer-margin, the presence of inflammatory polyps, and the condition of the intervening or surrounding mucosa (normal, congestive, edema and atrophy).

Thirteen probable intestinal Tbs showed a very similar gross appearance to that of definite Tb, and 7 of them had non-caseating epithelioid cell granuloma.

It is suggested that our macroscopic findings and classifications are useful for the preoperative diagnosis of intestinal tuberculosis.

INTRODUCTION

Intestinal tuberculosis (Tb) has been increasing in number even in the United State¹⁻⁵⁾ and Europe^{6,7)} in spite of the decrease of active pulmonary tuberculosis. Surgical operation is not recommended unless patients have severe intestinal stenosis and clinical complaints, or the lesion is associated with carcinoma. Therefore, an accurate preoperative diagnosis is essential to its therapy. Intestinal Tb has macroscopically characteristic features,⁷⁻¹⁵⁾ however, its definitive preoperative diagnosis is generally successful at a rate of about 66-73% by detecting Tb-bacilli (acid-fast bacilli) and/or caseating granuloma with biopsy, culture and special staining for Tb-bacilli and others.^{7,12,14)} Accordingly, it is desirable to know the macroscopic features of intestinal Tb and to make its macroscopic differential diagnosis preoperatively by endoscopic and radiographic examinations.

There is a long history of many macroscopic classifications of intestinal Tb (Table 1). Kuromaru's classification, published in 1932, is very popular in Japan, and includes eight macroscopic types classified on findings from the intestinal luminal surface of the lesion. However, this classification is limited to the active phase of Tb.⁸⁾

Tandon's classification, which was first reported in 1972 and is now used as a standard in Europe, encompasses three types: an ulcerative type, an ulcerohypertrophic type and healed Tb. Similar classifications are seen in the literature.^{1,10,11)} These are based on not only gross surface findings, but also phases of the disease. In the classifications, the macroscopic characteristics of the form of the ulcer are not directly and thoroughly expressed in items of ulcerative type and healed type Tb. Therefore, they are not readily available for preoperative radiological or endoscopic

Table 1. Macroscopic classifications of intestinal tuberculosis in the literature

Authors	Macroscopic type
Kuromaru ⁸⁾ (1932)	<ul style="list-style-type: none"> • type 1—small polypoid or round depressed lesion in lymph follicle. • type 2—round to oval open ulcer, relatively small size • type 3—round open ulcer with saw-toothed margin • type 4—circular or semi-circular open ulcer • type 5—longitudinal open ulcer, measuring up to 10 cm, very rare • type 6—big round to oval open ulcer • type 7—huge open ulcer with irregular margin. • type 8—wide geographic or serpiginous ulcer
Paustian ¹⁰⁾ (1959)	<ul style="list-style-type: none"> • Ulcerative type • Hypertrophic or hyperplastic type • Ulcerohypertrophic type
Kimoto ¹¹⁾ (1970)	<ul style="list-style-type: none"> • Ulcerative type • Tumor-forming type • Mixed type
Tandon ⁹⁾ (1972)	<ul style="list-style-type: none"> • Ulcerative type • Ulcerohypertrophic type • Healed tuberculosis
Joseph ¹⁾ (1975)	<ul style="list-style-type: none"> • Ulcerative form • Hypertrophic form • Mixed ulcerohypertrophic form
Watanabe ¹⁴⁾ (1977)	<ol style="list-style-type: none"> 1. Circular ulcer (open~healed) <ol style="list-style-type: none"> 1) linear form 2) girdle form 3) lead-pipe form 2. Round to oval ulcer or erosion (open~healed) 3. Irregular ulcer (open)

examinations.

Instead of these previous classifications, I have tried to make a new macroscopic classification of intestinal Tb which will prove available for endoscopic, radiological and pathological diagnosis, and for distinguishing Tb from other inflammatory bowel diseases macroscopically.

MATERIALS AND METHODS

The author also divided intestinal Tb into two groups according to the classification by Watanabe et al.^{14,17)} namely, definite Tb and probable Tb. At least one of the following criteria is essential for definite intestinal Tb: (1) the tubercle bacillus is proved by a Ziehl-Neelsen stain in the intestinal lesion or the regional lymph nodes; and/or (2) caseation necrosis is proved

in the above tissue; and (3) either (1) or (2) has previously been proved.

On the other hand, probable intestinal Tb is defined as that having both macroscopic and microscopic features: (1) macroscopic features consisting of narrow or broad circular ulcer(s) with a strong tendency to healing, or wide circular mucosa-atrophic zone with multiple scars (the latter is reported to be a typical feature for definite Tb);¹²⁾ and (2) microscopic features containing one or more of the findings described below: (a) large non-caseation granuloma(s) in addition to small or atrophic non-caseation granuloma(s) in the intestinal lesion and/or sclerotic granuloma(s) in the regional lymph nodes; (b) independent atrophic non-caseation granuloma(s) in the intestinal lesion and/or lymph nodes; (c) fibromusculosis in the intestinal wall, and sclerotic or calcified nodule(s) only in the lymph nodes; and (d) only fibro-

Table 2a. Macroscopic and microscopic findings of definite intestinal tuberculosis

Case	No.	Age	Sex	Site	Ulcer				
					Number	Depth	Most affected side		
1	I-543	70	F	Jejunum	Circ.	1	Open	II	Antimesenteric
				Jejunum	Circ.	2	Healed	II	Antimesenteric
2	NI-377	66	M	Ileum	Circ.	1	Open	II	Antimesenteric
				Ileum	Circ.	2	Healed	II	Antimesenteric
				Ileum	Oval	1	Open	II	Antimesenteric
3	NI-673	35	F	Ileum	Circ.	8	Open	II	Antimesenteric
				Ileum	Circ.	15	Healed	II	Antimesenteric
				Ileum	Round	Many	Healed	II	Antimesenteric
4	I-362	55	F	Ileum	Circ.	2	Healed	II	Antimesenteric
				Ileum	Oval	1	Open	III	Antimesenteric
5	I-368	78	F	Ileum	Circ.	2	Open	II~III	Antimesenteric
				Ileum	Circ.	3	Healed	I~II	Antimesenteric
6	I-693	58	F	Ileum	Circ.	2	Open	II	Antimesenteric
				Ileum	Circ.	2	Healed	II	Antimesenteric
7	I-753	52	F	Ileum	Circ.	5	Open	II~III	Antimesenteric
				Ileum	Circ.	3	Healed	II~III	Antimesenteric
8	NI-511	61	F	Ileum	Circ.	1	Open	II	Antimesenteric
				Ileum	Circ.	3	Healed	II	Antimesenteric
9	NI-2444	72	M	Ileum	Circ.	1	Open	I	Antimesenteric
				IC	Round	1	Open	I	Antimesenteric
				Ileum	Round, Oval	Many	Healed	II	Antimesenteric
10	NI-2484	76	F	IC	Circ.	1	Healed	II	Antimesenteric
				Ileum	Round	1	Open	II	Antimesenteric
11	NI-601	62	M	A	Circ.	1	Open	II	Free tenial
				A	Circ.	3	Healed	II	Mesocolic tenial
				A	Oval	Many	Healed	II	Diffuse
12	NI-2851	61	F	A	Round	16	Open	I~II	Diffuse
				A	Round, Oval	Many	Healed	II	Diffuse
13	NI-3005	66	F	IC	Circ.	1	Open	II	Antimesenteric
				A	Circ.	1	Open	II	Free tenial
				A	Circ.	2	Healed	II	Free tenial
				A	Round	2	Open	II	Free tenial
				A	Oval	Many	Healed	II	Diffuse
14	I-1080	46	F	A	Round, Oval	Many	Healed	II	Diffuse
15	NI-4304	72	F	Ileum	Circ.	2	Open	II	Antimesenteric
				Ileum	Circ.	5	Healed	II	Antimesenteric
				IC	Circ.	1	Open	II	Mesenteric
				A	Circ.	4	Open	II	Free tenial
				A	Circ.	2	Healed	II	Free tenial
				Ileum	Oval	Many	Healed	II	Antimesenteric
				A	Round, Oval	Many	Healed	II	Diffuse
16	I-340	66	M	A	Circ.	1	Open	II	Free tenial
				A	Circ.	2	Healed	II~III	Free tenial
17	I-384	47	F	A	Circ.	3	Healed	II~III	Free tenial
				A	Oval	3	Open	II~III	Free tenial
18	I-618	55	M	A	Circ.	1	Open	III	Free tenial
				A	Circ.	1	Healed	III	Free tenial
19	I-1020	73	F	Ileum	Circ.	1	Open	II	Antimesenteric
				Ileum	Circ.	1	Healed	II	Antimesenteric
				A	Circ.	1	Healed	II	Free tenial
				Ileum	Oval	3	Open	II	Antimesenteric
				Ileum	Oval	4	Healed	II	Antimesenteric
				A	Round, oval	2	Open	II	Free tenial
				A	Oval	1	Healed	II	Free tenial
20	NI-231	72	F	T	Circ.	3	Healed	II	Free tenial
				T	Round	2	Open	II	Mesocolic tenial
				T	Oval	Many	Healed	II	Diffuse
21	NI-2990	77	M	T	Oval	1	Open	II	Free tenial
				T	Round, Oval	Many	Healed	II	Diffuse
22	NI-3524	66	F	T	Circ.	2	Open	II	Mesocolic tenial
				T	Circ.	4	Healed	II	Mesocolic tenial
				T	Oval	Many	Healed	II	Diffuse
23	I-579	45	M	Duodenum	Circ.	1	Open	II	Antimesenteric
				Duodenum	Circ.	1	Healed	II	Antimesenteric
				T	Circ.	1	Healed	II	Free tenial
				Duodenum	Oval	3	Open	II~III	Antimesenteric
				T	Round, Oval	2	Open	II~III	Free tenial

IC; Ileocolonic region, A; Ascending colon, T; Transverse colon, Circ.; Circular

Table 2b. Macroscopic and microscopic findings of definite intestinal tuberculosis

Case	Wide circular atrophic zone	IP	Mucosa between ulcers	Antituberculous medication	Pulmonary tbc
1	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
2	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
	(-)	(-)			
3	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
	(-)	(-)			
4	(-)	(-)	Intact	(-)	?
	(-)	(-)			
5	(-)	(-)	Intact	(-)	?
	(-)	(-)			
6	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
7	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
8	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
9	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
	(-)	(-)			
10	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
	(-)	(-)			
11	(-)	(-)	Intact	(-)	(-)
	(+), 7.7×4.8 cm	(-)			
	(-)	(-)			
12	(-)	(+)	Intact	(+)	(+)
	(+), 15.1×7.2 cm	(-)			
13	(-)	(-)	Intact	(-)	(-)
	(-)	(+)			
	(-)	(+)			
	(-)	(+)			
	(+), 15.2×4.8 cm	(-)			
14	(+), 14.7×4.7 cm	(+)	Intact [Ca.]	(-)	(-)
15	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
	(-)	(-)			
	(-)	(-)			
	(-)	(-)			
	(-)	(-)			
	(-)	(-)			
16	(-)	(-)	Intact	(-)	?
	(-)	(-)			
17	(-)	(-)	Intact	(-)	?
	(-)	(-)			
18	(-)	(-)	Intact	(-)	(+)
	(-)	(-)			
19	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
	(-)	(-)			
	(-)	(-)			
	(-)	(-)			
	(-)	(-)			
	(-)	(-)			
20	(-)	(-)	Intact [Ca.]	(-)	(-)
	(-)	(-)			
	(+), 7.1×4.0 cm	(-)			
21	(-)	(-)	Intact [Ca.]	(-)	(-)
	(+), 13.0×9.5 cm	(+)			
22	(-)	(-)	Intact	(-)	(-)
	(-)	(-)			
	(+), 8.0×5.5 cm	(-)			
23	(-)	(-)	Intact	(-)	?
	(-)	(-)			
	(-)	(-)			
	(-)	(-)			
	(-)	(-)			

IP; Inflammatory polyps, [Ca.]; Accompanied with carcinoma

musculosis and non-specific inflammation in the intestinal wall.^{13,17)}

Intestinal Tb in this study consisted of 23 definite cases (Table 2) and 13 probable cases (Table 3), all of which were surgically resected from 1967 to 1990. In 12 definite and 10 probable cases, the entire lesion in the resected specimens were made step-wise into blocks. As disease controls, six ischemic enterocolitis with circular, girdle or oval ulcers (which are also found in Tb) (Table 4) and three radiation-induced enterocolitis with circular, girdle or oval ulcers, or with erosions (Table 5) were chosen.

The author checked for the following histologic evidence in each microscopic section: (1) fibrosis or fibromusculosis in the submucosa; (2) open and healed ulcers, and their depth; (3) caseation granuloma and non-caseation granuloma in the mucosa, submucosa, proper muscle and subserosa.

Thereafter the author made a mapping of the above microscopic findings on macroscopic color prints with cutting lines of the lesion to compare macro-

scopic abnormalities with histologic findings, and to confirm the form and number of ulcers.

RESULTS

1. Definite intestinal Tb

In 23 definite intestinal Tbs, 20 cases (86.9%) had open and/or healed circular ulcer(s), two other cases had a circular atrophic zone with multiple circular and round ulcer scars and small round open ulcers (Cases 12 and 21 in Table 2), and the remaining one (Case 14) had only a circular mucosa-atrophic zone with multiple circular and round ulcer scars. In addition to these macroscopic lesions, the active Tb cases had many small round to oval erosions.

A circular ulcer was found in 12 of 13 cases with small intestinal Tb and in 10 of 13 cases with colonic Tb. It was often associated with islands of the remaining or regenerating mucosa in it. The width of open circular ulcers was 1.2 ± 0.6 cm (mean \pm S.D.)

Table 3a. Macroscopic and microscopic findings of probable intestinal tuberculosis

Case	No.	Age	Sex	Site	Ulcer				
					Number	Depth	Most affected side		
1	NI-3169	63	M	Jejunum	Circ.	3	Open	II	Antimesenteric
				Jejunum	Circ.	6	Healed	II	Antimesenteric
2	NI-1467	75	F	Ileum	Circ.	4	Healed	II	Antimesenteric
				IC	Circ.	1	Healed	II	Antimesenteric
				Ileum	Oval	3	Open	I~II	Mesenteric
				Ileum	Oval	Many	Healed	II	Antimesenteric
3	NI-1486	69	M	Ileum	Circ.	3	Open	II~III	Antimesenteric
				Ileum	Circ.	4	Healed	II~III	Antimesenteric
				Ileum	Round, Oval	Many	Healed	II~III	Antimesenteric
4	NI-2323	55	F	Ileum	Circ.	2	Open	II	Antimesenteric
				Ileum	Circ.	4	Healed	II	Antimesenteric
				Ileum	Round, Oval	Many	Open	II	Diffuse
5	I-492	66	M	Ileum	Circ.	6	Healed	II	Antimesenteric
6	I-626	56	M	Ileum	Circ.	1	Open	III	Antimesenteric
				Ileum	Circ.	4	Healed	II	Antimesenteric
7	I-866	60	F	Ileum	Circ.	10	Open	II~III	Antimesenteric
				Ileum	Circ.	10	Healed	II~III	Antimesenteric
8	NI-235	60	M	A	Circ.	2	Healed	II	Free tenial
9	NI-1989	61	F	A	Circ.	3	Healed	II	Free tenial
				Ileum	Round	6	Healed	II	Antimesenteric
				A	Oval	Many	Healed	II	Diffuse
10	I-588	31	F	Ileum	Circ.	1	Open	II	Antimesenteric
				Ileum	Circ.	4	Healed	II	Antimesenteric
				IC	Circ.	1	Open	II	Mesenteric
				Ileum	Oval	Many	Healed	II	Diffuse
11	I-867	43	M	A	Round, Oval	Many	Healed	II	Diffuse
12	I-961	60	F	IC	Circ.	1	Healed	I	Mesenteric
				A	Round, Oval	Many	Healed	I	Diffuse
13	I-87	82	F	A	Circ.	1	Healed	II	Antimesenteric
				A	Round, Oval	Many	Healed	II	Diffuse

IC; Ileocolonic region, A; Ascending colon, Circ.; Circular

Table 3b. Macroscopic and microscopic findings of probable intestinal tuberculosis

Case	Wide circular atrophic zone	IP	Mucosa between ulcers	Antituberculous medication	Pulmonary tbc	Granuloma
1	(-) (-)	(-) (-)	Intact	(-)	(-)	(+)
2	(-) (-) (-)	(-) (-) (-)	Intact	(-)	(-)	(-)
3	(-) (-) (+), 6.4×6.1 cm	(-) (-) (-)	Intact	(-)	(-)	(+)
4	(-) (-) (-)	(-) (-) (-)	Intact	(-)	(+)	(+)
5	(-)	(-)	Intact	(+)	(+)	(-)
6	(-) (-)	(-) (-)	Intact	(+)	(-)	(-)
7	(-) (-)	(-) (-)	Intact	(+)	(-)	(-)
8	(-)	(+)	Intact	(+)	(+)	(+)
9	(-) (-) (+), 12.8×7.2 cm	(-) (-) (-)	Intact [Ca.]	(-)	(-)	(-)
10	(-) (-) (+), 6.0×4.0 cm (-)	(-) (-) (-)	Intact	(-)	(-)	(+)
11	(+), 5.7×5.0 cm	(+)	Intact	(-)	?	(-)
12	(-) (+), 6.0×6.0 cm	(-) (-)	Intact	(-)	(-)	(+)
13	(-) (-)	(+) (+)	Intact [Ca.]	(-)	?	(+)

IP; inflammatory polyps, [Ca.]; Accompanied with carcinoma

in the former and 1.3 ± 1.2 cm in the latter. Four of the 20 cases with circular ulcer(s) also had a wide circular mucosa-atrophic zone with multiple circular and round ulcer scars. This wide mucosa-atrophic zone was detected in 7 of 13 colonic or ileo-colonic Tbs, but not in small intestinal Tb; its longitudinal length was 10.1 ± 3.7 cm.

Sixteen cases (69.6%) had round and oval ulcers (open-healed). In the small intestine, these ulcers (open-healed) occurred mainly on the anti-mesenteric side of the small intestine with a strong tendency to extend in a circular direction. In the colon, small round or oval open ulcers were predominantly found at the distal margin of a wide circular mucosa-atro-

phic zone with multiple ulcer scars. Many inflammatory polyps were found in 4 cases (17.3%) at the ulcer margin or in the wide circular mucosa-atrophic zone of the colon (Fig. 1-a, b), but not in the small intestine.

The ulcer-margin of the active open ulcers was undermined becoming gradually depressed in healing or healed ulcers. The depth of the ulcer was U1-I- II (partly U1-III). The mucosa between circular ulcers or round, oval ulcers was either whitish yellow or yellowish brown, and of a normal appearance.

In definite Tbs, Case 12 alone was treated with anti-tuberculous medication for a week. It showed a wide circular mucosa-atrophic zone (from the

Table 4. Macroscopic and microscopic findings of ischemic enterocolitis

Case	No.	Age	Sex	Site	Ulcer					
					Form	Widest side	Number	Phase	Depth	Most affected side
1	NI-2790	75	F	Ileum	Circular	Mesenteric	1	Healing	I	Mesenteric
2	NI-3496	57	F	Ileum	Circular	Mesenteric	1	Healing	I~IV	Mesenteric
3	I-444	60	F	Ileum	Circular	Mesenteric	1	Healing	I~IV	Mesenteric
4	NI-3525	66	F	D	Semicircular	Free tenial	1	Healing	I	Free tenial
5	NI-1214	59	M	D	Cirdle	Mesocolic tenial	1	Active	I~IV	Mesocolic tenial
					S	Girdle+longit.	Mesocolic tenial	1	Active	I~III
6	NI-3324	71	M	S	Oval	Between mesocolic and free tenial	1	Healing	I	Between mesocolic and free tenial

Case	Granulation polyps	Wide circular atrophic zone	IP	Surrounding mucosa	
				Edema	Hypermia
1	(+++)	(-)	(-)	(++)	(++)
2	(-)	(-)	(-)	(-)	(+)
3	(++)	(-)	(-)	(++)	(++)
4	(++)	(-)	(-)	(+)	(+)
5	(+++)	(-)	(-)	(+++)	(+)
	(+++)	(-)	(-)	(+++)	(+)
6	(++)	(-)	(-)	(+)	(+)

D; Descending colon, S; Sigmoid colon, IP; Inflammatory polyps

Table 5. Macroscopic and microscopic findings of radiation enterocolitis

Case	No.	Age	Sex	Site	Ulcer				
					Form	Number	Phase	Depth	Most affected side
1	NI-3713	76	F	Ileum	Circular	3	Healing	I~II	Mesenteric
					Circular	1	Healing	II	Antimesenteric
2	NI-3732	47	F	Ileum	Oval	1	Open (active)	IV	Mesenteric
					Oval	3	Healing	II~IV	Mesenteric
3	NI-526	77	F	S	Oval	1	Open (active)	III	Mesocolic tenial
					Circular	1	Open	I~II	Mesocolic tenial

Case	Wide mucosal atrophy without multiple scars	IP	Surrounding Mucosa		
			Edema	Hyperemia	Disappearance of folds
1	(+++)	(-)	(++)	(+++)	(+++)
	(+++)	(-)	(++)	(+++)	(+++)
2	(+)	(-)	(+++)	(+)	(++)
	(+)	(-)	(++)	(+)	(++)
3	(+)	(-)	(+++)	(+++)	(+)
	(+)	(-)	(+++)	(++)	(+)

S; Sigmoid colon, IP; Inflammatory polyps

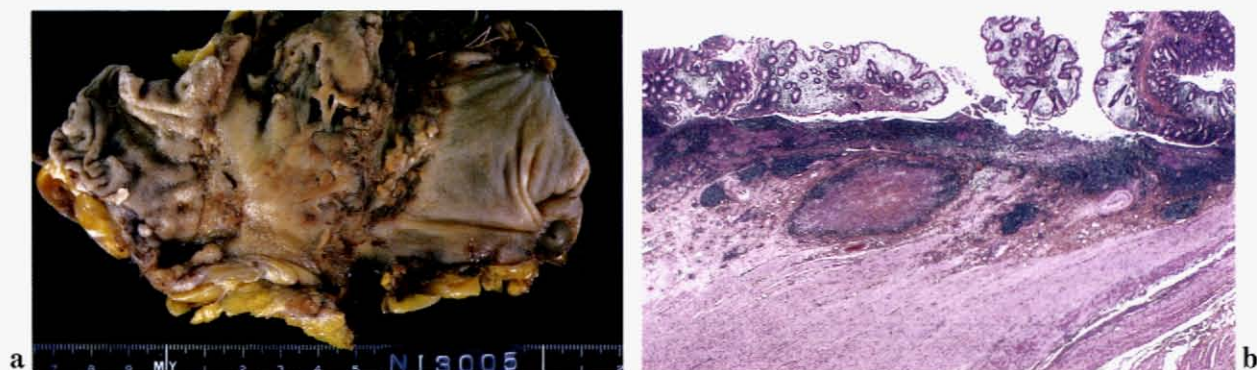


Fig. 1. **a:** Definite tuberculosis of the ileocecal valve and the ascending colon. There are three circular open and healing ulcers with inflammatory polyps and mucosal bridge. **b:** Open shallow ulcer with caseation granuloma and inflammatory polyps. HE. (Case 13 in Table 2)

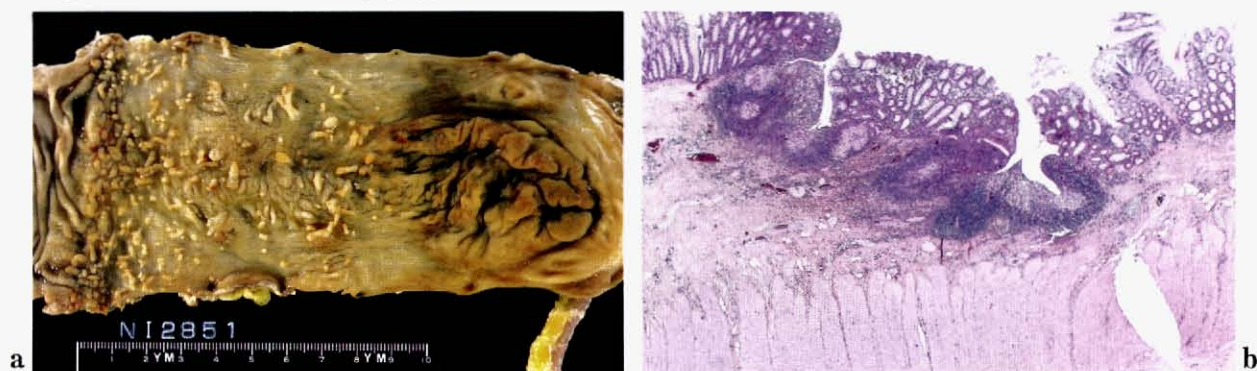


Fig. 2. **a:** Definite tuberculosis of the ascending colon. A wide circular mucosa-atrophic zone has 16 small round open ulcers at the anal margin of the lesion. **b:** Open shallow ulcer with non-caseation granulomas and inflammatory polyps. HE. (Case 12 in Table 2, treated with medicine)



Fig. 3. Definite tuberculosis of the ileum. There are 8 open circular ulcers and circular healed ulcers. (Case 3 in Table 2).

ileocecal valve to the ascending colon) with numerous inflammatory polyps on the ascending colon and 16 small round open ulcers at the anal margin of the lesion (Fig. 2-a, b, Case 12). Histologically, the atrophic zone had multiple round, oval or circular ulcer scars and diffuse submucosal fibrosis. Epithelioid cell granulomas with or without caseation necrosis were present in the open ulcer areas, but not in the atrophic scar areas.

The other 22 cases had never been treated with anti-tuberculous medication. Twenty of the 22 cases (90.9%) had an open circular ulcer (1 case), or open and healed multiple circular ulcerative lesions (15 cases), or healed circular ulcers (4 cases) in the resected specimens, and the remaining two had a wide circular mucosa-atrophic zone with multiple ulcer scars. All of the 22 cases contained caseation granulomas in the intestinal wall and/or regional lymph nodes (Fig. 3, Case 3). Thirteen cases had caseation granulomas in the intestinal wall (9 cases of open ulcers, 3 cases of healed ulcers, 1 case of open and healed ulcers), 5 cases in the regional lymph

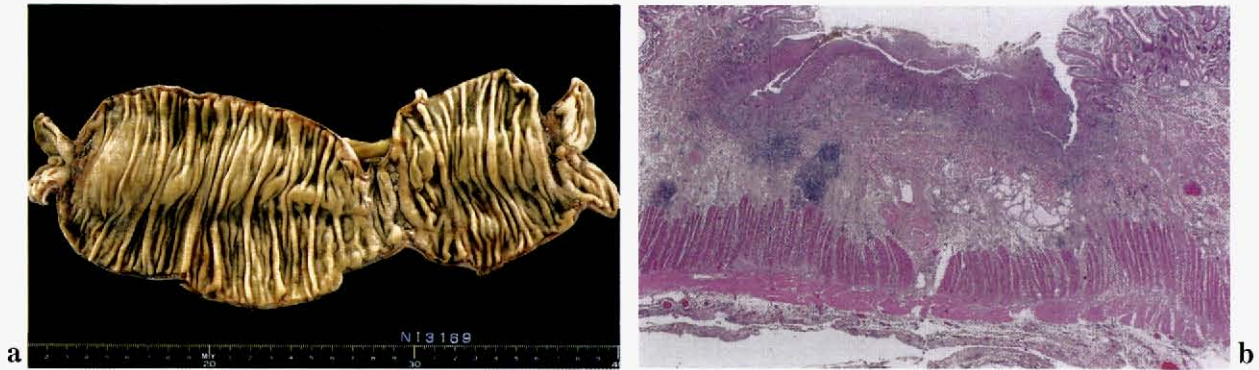


Fig. 4. **a:** Probable tuberculosis of the jejunum. There are 3 circular open ulcers and multiple small ulcer-scars. No caseation granuloma or tubercle bacillus are proved. **b:** Healing shallow ulcer with no epithelioid granuloma. HE. (Case 1 in Table 3).

nodes alone and 4 cases in both the intestinal wall and regional lymph nodes (3 cases of healed ulcers, 1 case of open and healed ulcers).

2. Probable intestinal Tb

Twelve (92.3%) of 13 probable intestinal Tbs had open and/or healed circular ulcer(s), and the remaining one (Case 11 in Table 3) had a wide circular mucosa-atrophic zone with multiple ulcer scars in the ascending colon.

The circular ulcers were found in 8 of 9 cases of small intestinal Tb, and in 6 of 7 cases of colonic and/or ileocolonic Tb being associated with islands of the remaining or regenerating mucosa. The width of circular ulcers was 1.3 ± 0.8 cm in the former and 0.6 ± 0.4 cm in the latter. The wide circular mucosa-atrophic zone with multiple ulcer scars was detected in 4 of 7 cases of colonic and ileocolonic Tb, its longitudinal length being 7.6 ± 3.0 cm, and in 1 of 9 cases of small intestinal Tb, with a length of 6.4 cm.

Eight cases (57.1%) had open and/or healed round, oval ulcers. These oval ulcers tended to advance in a circular direction. Multiple inflammatory polyps were found only on the colon of 3 of 7 colonic and/or ileocolonic Tb cases. The ulcer margin was gradually depressed. The mucosa between circular ulcers or round, oval ulcers was normal in gross appearance.

Cases 5, 6, 7 and 8 were treated with antituberculous drugs and had circular open and/or healed ulcers. They did not contain epithelioid cell granuloma in the intestinal wall or regional lymph nodes even in those cases (Cases 5, 6 and 7) where the whole resected specimen was sectioned step-wise and examined histologically. The remaining 9 cases which had open and/or healed ulcerative lesions were not treated with medicine, but here, too, the open



Fig. 5. Ischemic colitis, ulcerative type, healing phase. a semicircular ulcer of the descending colon with granulation tissue polyps at the periphery of the ulcer-base. (Case 4 in Table 4)

ulcers showed a strong tendency toward healing (Fig. 4a, 4b). In these 9 cases, 4 cases (Cases 1, 3, 4 and 10) had epithelioid cell granulomas in open circular ulcers and Cases 12 and 13 had them in healed circular ulcers, but the remaining 3 cases had no epithelioid cell granuloma, even though the entire lesions were sectioned step-wise.

3. Ischemic enterocolitis (Table 4)

There was only one example of ulcerative lesion in ischemic enterocolitis (Fig. 5) among 5 of 6 cases, and two in the remaining one in the resected specimens and also on radiological and endoscopic examination. The ileal lesion was located in the proximal ileum, and the colonic lesion was located in the descending or sigmoid colon, but not in the cecum, ascending colon or transverse colon. Three ileal circular and one colonic semicircular ulcers had the largest widths and were severely affected on the mesenteric and tenial sides, respectively. Granulation tissue polyps



Fig. 6. Radiation colitis. (Case 1 in Table 5)

were found at the ulcer-base in 5 of 6 cases, and the case without the polyp showed a marked healing of the ulcer. Congestion in the surrounding mucosa was detected in all of the cases, and edema in 5 of them.

An oval ulcer of the sigmoid colon (Case 6) had a longitudinal major axis between the mesenteric and the antimesenteric teniae, with many granulation polyps at the ulcer base, and edema and congestion in the surrounding mucosa. Case 5 had a 5 cm-girdle

ulcer and also a 6 cm-girdle ulcer with longitudinal ulcers which were surgically resected 3 months later, after the acute onset of symptoms. They were still active refractory ulcers with many granulation polyps at the ulcer base and conspicuous edema, but with mild congestion in the surrounding mucosa. The 5 cm-girdle ulcer had a short (1 cm) lineal extension along the mesenteric tenia.

4. Radiation enterocolitis (Table 5)

All of these three cases had a past history of radiation therapy to gynecological or urological malignancy ranging from 8 months to 28 years as well as the histological features typical of radiation-induced enterocolitis.¹⁸⁾

Macroscopically, the most characteristic features, found in the surrounding or intervening mucosa of ulcerative lesion(s), were conspicuous edema, hyperemia and the disappearance of mucosal folds (wide mucosal atrophy without multiple ulcer-scars) occasionally associated with swollen disrupted folds (Fig. 6). There were no inflammatory polyps in any of the cases.

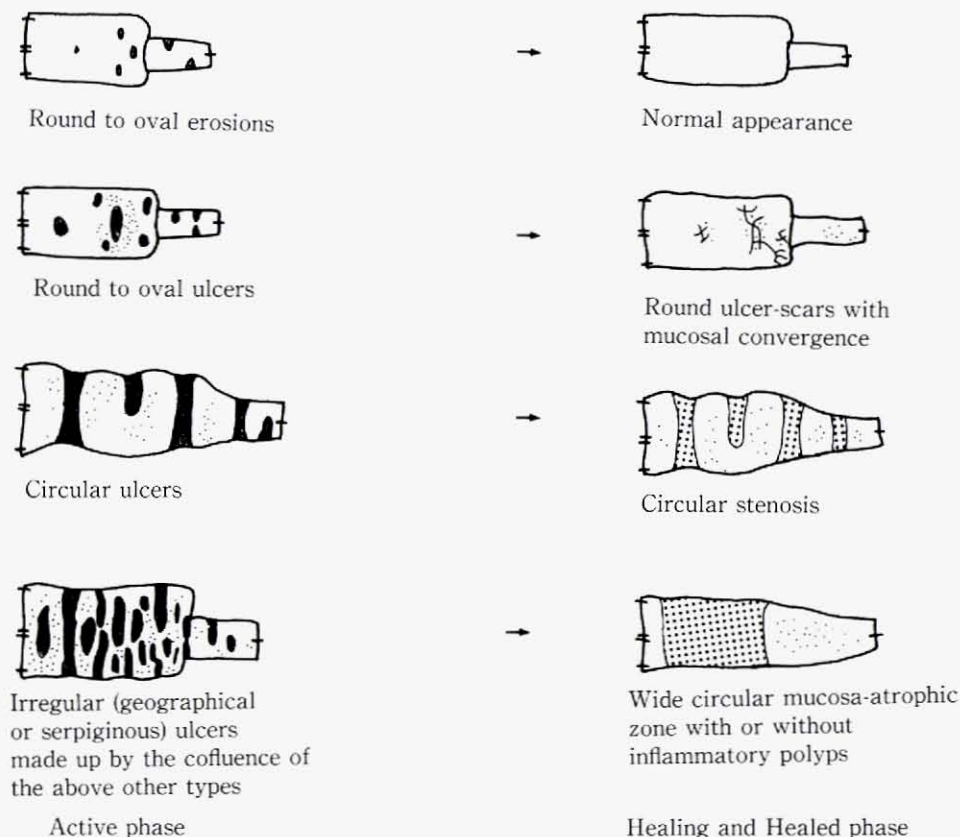


Fig. 7. Macroscopic classification of intestinal tuberculosis.

Five oval ulcers (Case 2 and 3 in Table 5) were located on the mesentery or mesocolic tenia, and 4 of the 5 circular ulcers showed the largest width and depth of the ulcer on the mesentery or mesocolic tenia.

DISCUSSION

1. Macroscopic classification and characteristics of intestinal tuberculosis

All of the 23 definite intestinal tuberculosis in this study had circular open and/or healed ulcer(s) or a wide circular mucosa-atrophic zone with multiple ulcer-scars at the time of the clinical symptom, stage or surgically resected stage.

In addition to these types of ulcers, 16 cases (66.7%) of the 23 definite Tb cases contained round and oval ulcers, including open and healed, some of which tended to advance in annular direction. All of the 23 cases also had open to healed small erosions. From these data, a classification of the macroscopic types of intestinal Tb and their transformations is proposed, as shown in Fig. 7.

Kuromaru classified intestinal Tb into 8 types, describing the circular or semicircular open ulcer as a typical form for intestinal Tb.⁸⁾ However, his macroscopic typing is too much complicated to be suitable for clinical or preoperative diagnosis, nor did he classify healed intestinal Tb. In contrast, other investigators excepting Watanabe et al. In Table 1 divided intestinal Tb into three types, and reported that the ulcerohypertrophic type was the typical form, but failed to explain macroscopic ulcer forms of open and healed Tbs thoroughly. In my study, no ulcerohypertrophic type Tb was found, and it seems rather to be an inflammatory mass with thickening of the intestinal wall by active circular ulcer, judging from photos in the literature.^{1,9,10)}

It has been reported that macroscopic diagnosis of intestinal Tb composed of round and oval ulcers is difficult because there are many other inflammatory bowel diseases, i.e., Crohn disease, intestinal Behçet's disease, simple ulcer, ischemic enterocolitis, typhoid fever, etc.¹⁷⁾ Nonetheless, Watanabe et al, insist that it is possible to macroscopically distinguish these by judging the prevalent site of the ulcer, its location to the mesentery, depth and multiplicity of the ulcer(s), and macroscopic findings of the surrounding and intervening mucosa of the ulcers.^{13,15)}

Other investigator's data and mine suggest that circular open and/or healed ulcers, and a wide circu-

lar mucosa-atrophic zone with multiple ulcer-scars particularly at the ileocolonic region or ascending colon are characteristics of intestinal Tb.

2. Macroscopic differential diagnosis

It is necessary to distinguish intestinal Tb with typical macroscopic features from other inflammatory bowel diseases with circular ulcers.

First let us consider the macroscopic differential diagnosis between intestinal Tb and ischemic enterocolitis. In ischemic (entero)colitis, a longitudinal ulcer is most common, and circular (girdle) ulcer is infrequent.¹⁵⁾ Ischemic enteritis or colitis with circular ulcer occurs as one lesion in most cases, and is congestive and edematous in the surrounding mucosa in active and healing phases (Table 4 and 6).^{13,15,17)} The circular ulcer is widest on the mesenteric side of the small intestine or is generally widest on the mesocolic tenia, and is most affected on these sides. Inflammatory polyps are never found in ischemic enteritis or colitis in the active to healed phase.¹⁵⁾

In addition, ischemic colitis predominantly develops in the left-sided colon and clinically shows acute attacks by bloody stools, abdominal pain and diarrhea, spontaneously healing generally within 2 months without recurrence.¹⁵⁾ In contrast, intestinal Tb predominantly occurs in the right-sided colon, and is chronic both at its onset and in its course, in case of no internal medication.

Even in the healed stage, ischemic enteritis or colitis with circular ulcer can be diagnosed or suspected by the number of lesions, its prevalent site, lack of inflammatory polyps, and history of acute attack and natural course. Therefore, I believe it is possible to make macroscopic differential diagnosis of intestinal Tb from ischemic colitis and enteritis. Preoperative diagnosis of ischemic enterocolitis will become more accurate when a biopsy is performed.

Second, let us discuss the macroscopic differential diagnosis between intestinal Tb and radiation enterocolitis. Macroscopically, radiation enteritis or colitis with a circular ulcer is completely different from intestinal Tb in the active to healed stage. The former shows conspicuous edema, hyperemia and the disappearance of mucosal folds between the intervening mucosa of ulcers (Tables 5 and 6).^{13,15,17)}

Third, we have to distinguish intestinal Tb from chronic hemorrhagic multiple intestinal ulcers of unknown etiology. Watanabe precisely described for the first time macroscopic and microscopic diagnostic criteria for chronic hemorrhagic multiple intestinal ulcers.⁸⁾ The criteria are as follows: (1) macro-

Table 6. Differential diagnosis of intestinal tuberculosis and other inflammatory bowel diseases with circular (girdle) ulcer(s)

	Intestinal tuberculosis			Ischemic enterocolitis		Radiation enterocolitis			Chronic hemorrhagic multiple ulcers
Macroscopic findings									
Prevalent site	A~T	IC	Ileum	T(left)~S	Ileum	Sigmoid colon	Rectum	Ileum	Middle or lower small intestine
Circular (Girdle) ulcer	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
	Sharply undermined, UL-II>III →Circular stenosis Circular atrophic zone (Mainly in colon)			Gradually depressed UL-II~III →Circular stenosis Widest on mesentery or tenia		UL-II~IV →Circular stenosis			Sharply demarcated, UL-I Stricture (-)
Number of circular ulcer	Multiple~(1)			1~(2)		A few		1	Multiple
Round, Oval ulcer	(+) on the anti-mesenteric site →extend in circular direction			(+) with long axis along tenia		(+) Many erosions (+) along mesentery Circular mucosa-atrophic zone			(+)
Longitudinal ulcer	(-)			(+) along tenias	(+) along mesentery	(-)			(-)
Intervening mucosa	Normal			Congestion (++)→(-) Edema (++)→(-)		Congestion (+)~(++) Edema (+)~(++)			Normal
Inflammatory polyp	17% limited to colon			(-)		(-)			(-)
Microscopic findings									
Caseation granulomas	(+) (++)			(-)		(-)			(-)
Non-caseation granulomas	(+) (++)			(-)		(-)			(-)
Fibrosis in submucosa	(+)~(++)			(+)~(++)		(+)~(++)			(-)~(+)
Edema	(-)~(+) in active phase			(++)→(-)		(+)~(++)			(-)~(+)
Congestion	(-)~(+)			(+++)		(+)~(++)			
Vascularity	(-)~(+)			(+++)		(-), (+)			(-)
Hyalinous thickening with foamy cells, artery	(-)			(-)		(+) (++)			
Hemosiderin	(-)			(+) (++)		(-)			(-)

scopically, ulcers are narrow-circular and semicircular, shallow (mostly UL-I and sometimes shallow UL-II), multiple (4-20 in number), and their marginal mucosa is red and atrophic, the ulcer margin is sharply demarcated, stenosis is mild, and intervening mucosa is normal. The prevalent site is the ileum to middle small intestine, and ileocecal valve is never affected. (2) Microscopically, the ulcers show non-specific findings with vascular granulation tissue in the mucosa, and mild fibrosis. Inflammatory change is limited to the shallow ulcers. As shown in Table 6, it is possible to macroscopically distinguish intestinal Tb from this disease.

A differential diagnosis of Tb from Crohn's disease is most important because these often have a similar epithelioid-cell granuloma histologically but are different in internal medication. In contrast to intestinal Tb, Crohn's disease macroscopically shows longitudinal ulcers along the mesentery or the tenias, a cobblestone appearance of the mucosa of a yellowish white color, or, particularly in the colon, diffuse inflammatory polyposis and a cobblestone appearance.¹⁵⁾ If a circular ulcer is present in Crohn's disease, the ulcer is always accompanied by a longitudinal ulcer or cobblestone appearance.¹⁵⁾ In addition, the circular or round ulcers of Crohn's disease are wider or located on the mesenteric side.¹⁵⁾ Therefore, it is easy to macroscopically distinguish Tb from Crohn's disease.¹⁵⁾

3. Probable intestinal tuberculosis

The 13 probable intestinal Tbs in this study showed macroscopic findings similar to those of definite intestinal Tb. Seven of 13 cases revealed non-caseation granulomas in the intestinal wall and/or regional lymph nodes.

Moreover, macroscopic findings of all probable cases of Tb were completely different from ischemic enteritis and colitis, or radiation enterocolitis or chronic hemorrhagic multiple intestinal ulcers.

Therefore, the group diagnosed as probable intestinal Tb in this study may be considered as the healing or healed stage of intestinal Tb.

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