Title	Angiography of Abdominal Lymphomas
Author(s)	高橋, 信; 沼口, 雄治; 岸川, 高 他
Citation	日本医学放射線学会雑誌. 1980, 40(1), p. 1-9
Version Type	VoR
URL	https://hdl.handle.net/11094/20058
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Angiography of Abdominal Lymphomas

Makoto Takahashi*, Yuji Numaguchi, Takashi Kishikawa,

Yoshiki Tsukamoto, Jun Ikeda, M.D. and

Keiichi Matsuura

From the Department of Radiology, Faculty of Medicine, Kyushu University,

Fukuoka, Japan

*Present address: Department of Radiology, National Kyushu Cancer Center Hospital,

Fukuoka, Japan

腹部悪性リンパ腫の血管造影診断

国立病院九州ガンセンター放射線部

高　橋　　　信

九州大学放射線科学教室

沼　口　雄　治　　岸　川　　　高　　塚　本　良　樹

池　田　　　純　　松　浦　啓　一

消化管に発生した5例を含む22例の腹部悪性リンパ腫に血管造影を行い，その所見を検討した．症例は後腹膜11例，脾臓3例，大腸3例，胃2例，肝臓，腸間膜，腹膜各1例であった．組織診断は細網肉腫15例，リンパ肉腫5例，ホジキン病2例であった．後腹膜悪性リンパ腫の11例中7例に，血管の圧排，狭窄，新生血管などを認めた．肝臓，脾臓，腸間膜，腹膜の悪性リンパ腫6例でも同様の所見が得られた．胃の悪性リンパ腫2例では動脈壁の狭小化と潅流静脈の拡張が主な所見であった．大腸悪性リンパ腫の3例では動脈の圧排，壁の狭小化，新生血管，腫瘍濃染や潅流静脈の拡張がみられた．腹部の悪性リンパ腫では，壁のなど狭小化が最も多い所見（22例中14例）であり悪性リンパ腫に比較的特有な所見と考えられた．新生血管と腫瘍濃染は，それぞれ8例，5例にみられた．管腔臓器の悪性リンパ腫と癌の鑑別は困難であると思われた．

INTRODUCTION

Angiography for diagnosing abdominal lymphomas has been widely reported, but most reported cases have involved lymphomas of the retroperitoneal region, the liver, or the spleen. Only a few have involved the gastrointestinal tract (1–3). Results of our angiography in 22 abdominal lymphomas, including 5 reticulum cell sarcomas of the gastrointestinal tract, are reported here.

METHOD AND MATERIALS

Percutaneous transfemoral catheter technique was used in all cases; polyethylene catheters (PE260 or PE240) for abdominal aortography; Red-Kifa catheters, for selective angiography. The contrast medium was seventy-six percent sodium and methylglucamine diatrizoate, and serial angiography was at the rate of 15 exposures in 19 seconds.

The cases included 15 reticulum cell sarcomas, 5 lymphosarcomas, and 2 Hodgkin's disease (Table 1). Histological diagnoses were established by laparotomy in 10 cases; biopsy, in 8; autopsy in 3; and cytology of ascitic fluid in 1 case. Among the 7 patients whose histological diagnoses were

Table 1.　Abdominal lymphomas

Case	Age	Sex	Histology	Method of diagnosis	Involved site
1	61	M	RCSA	laparotomy	retroperitoneum
2	68	F	RCSA	laparotomy	retroperitoneum
3	41	M	RCSA	biopsy	retroperitoneum
4	72	M	RCSA	autopsy	retroperitoneum
5	40	M	RCSA	cytology	retroperitoneum
6	40	M	LSA	laparotomy	retroperitoneum
7	65	M	LSA	laparotomy	retroperitoneum
8	39	M	LSA	autopsy	retroperitoneum
9	66	M	LSA	biopsy	retroperitoneum
10	45	F	HD	laparotomy	retroperitoneum
11	48	M	HD	biopsy	retroperitoneum
12	68	M	RCSA	laparotomy	spleen
13	34	F	RCSA	biopsy	spleen
14	43	M	RCSA	biopsy	spleen
15	52	M	RCSA	laparotomy	large intestine
16	38	F	RCSA	biopsy	large intestine
17	66	M	RCSA	biopsy	large intestine
18	48	M	RCSA	laparotomy	stomach
19	54	M	RCSA	laparotomy	stomach
20	63	F	LSA	biopsy	liver
21	53	M	RCSA	laparotomy	mesentery
22	62	M	RCSA	autopsy	peritoneum

RCSA:　Reticulum cell sarcoma
LSA:　　Lymphosarcoma
HD:　　Hodgkin's disease

by biopsy, the specimens of 6 were from other than abdominal sites, but they were histologically identical with the abdominal lesions. Sites included 11 in the retroperitoneum; 3 in the spleen; 3 in the large intestine; 2 in the stomach and 1 each in the liver, mesentery and peritoneum.

RESULTS (Table 2)

Abnormalities of 7 of the 11 cases whose primary lesions were retroperitoneal were demonstrated angiographically. Most frequent were stretching and displacement of the superior mesenteric artery, which occurred in 5 of the 11 cases. Arterial encasement occurred in three cases. Two of which, it was present in the celiac trunk or the common hepatic artery (Fig. 1). In 1 of the latter, it was in the

Table 2. Angiographic manifestations of abdominal lymphomas

Localization	Cases no.	Arterial displace-ment	Arterial encase-ment	Neovascul-arity	Tumor stain	Densely opacified draining veins
Retroperitoneum	11	7	3	2	1	0
Spleen	3	3	3	2	0	0
Stomach	2	0	2	0	0	2
Large intestine	3	3	3	2	1	3
Liver	1	1	1	1	1	0
Mesentery	1	1	1	0	1	1
Peritoneum	1	0	1	1	1	0

origin of the right hepatic artery, a branch of the superior mesenteric artery. On the third case, encasement was near the origin of the left renal artery. "Smooth encasement" occurred in all 3 cases; none of them had a serrated appearance. Splenic vein occlusion was noted in 1 case.

Among the 3 splenic lesions, 2 had multiple and one had isolated avascular areas, with stretching of the affected arteries (Fig. 2). There was encasement of intrasplenic branches in three cases; and fine neovascularity of the peripheral vessels in 2. In 1 case the splenic vein was occluded, resulting in a collateral circulation.

In 3 patients with lymphoma of the large intestine the lesions were located mainly in the cecum and the ascending colon, with dilatation and encasement of the vasa recta. The venous phase showed
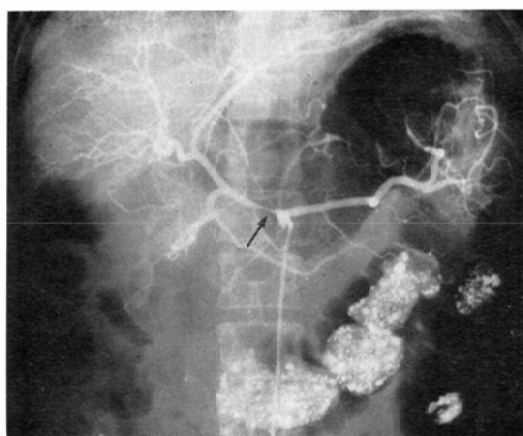

Fig. 1. Reticulum cell sarcoma in the retroperitoneal region. Celiac arteriography shows smooth encasement of the common hepatic artery (arrow). There was marked stenosis of the portal and occlusion of the splenic veins at this portion in the venous phase (not shown here).
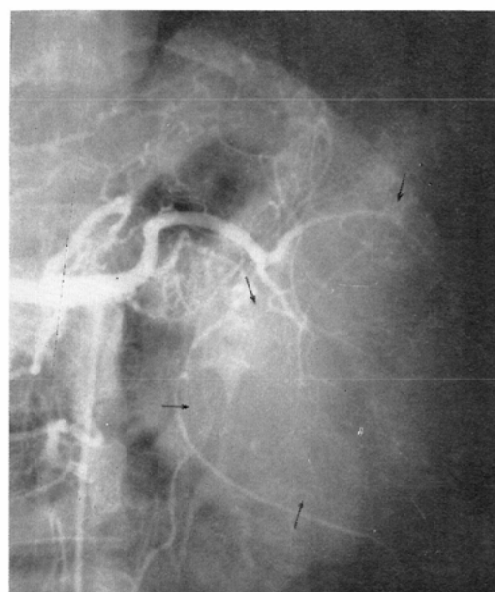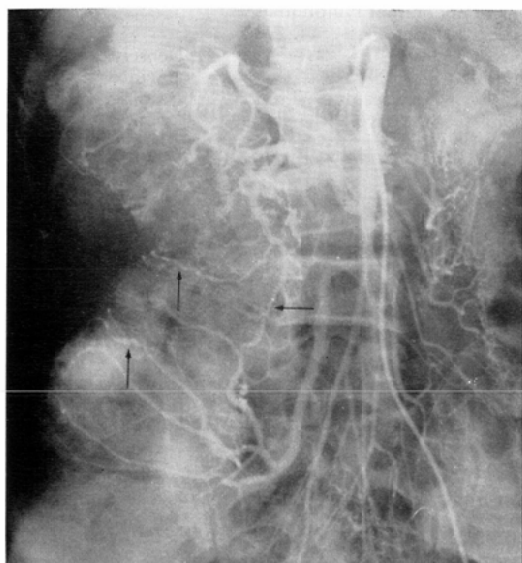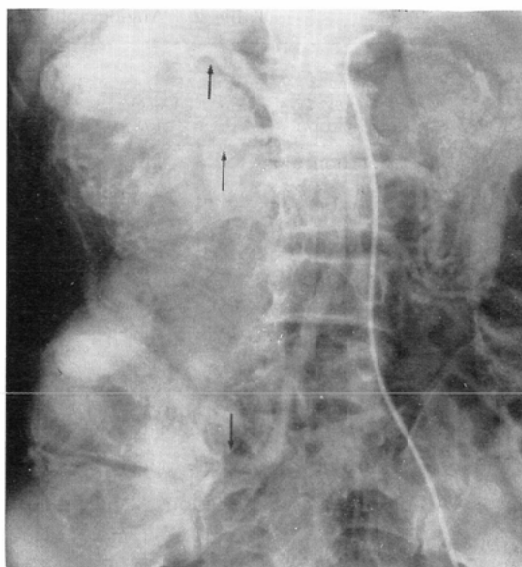

Fig. 2. Reticulum cell sarcoma in the spleen. Splenic arteriography reveals displacement and stretching of the splenic arterial branches, and fine neovascularity indicating intrasplenic masses (region surrounded by arrows).
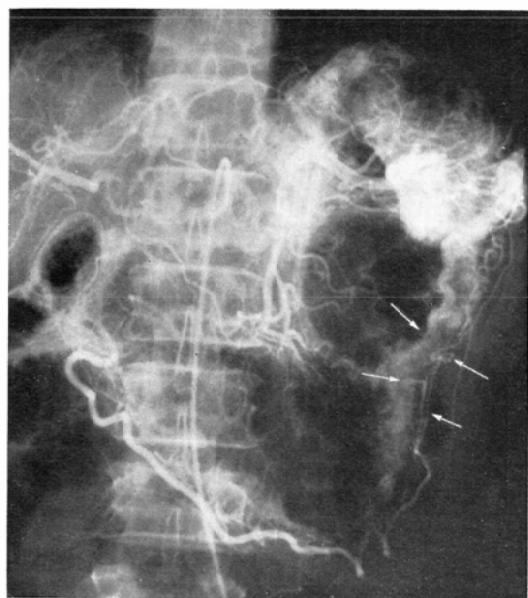
A. Superior mesenteric arteriography demonstrates marked irregularity of the marginal artery and of the vasa recta (arrows).
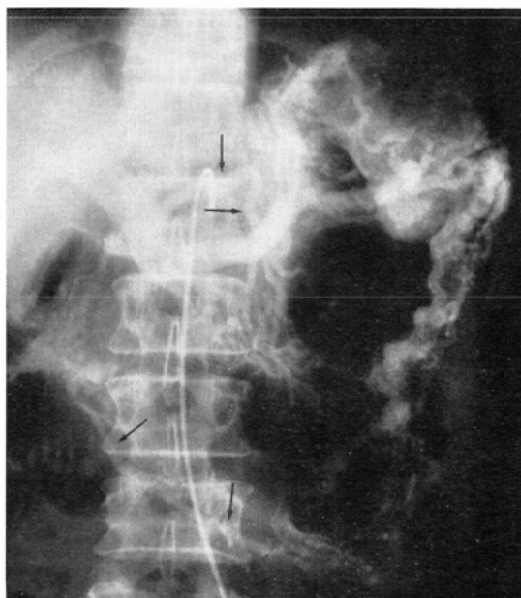
B. The venous phase shows marked tumor stains in the ascending colon and densely opacified draining veins (arrows).

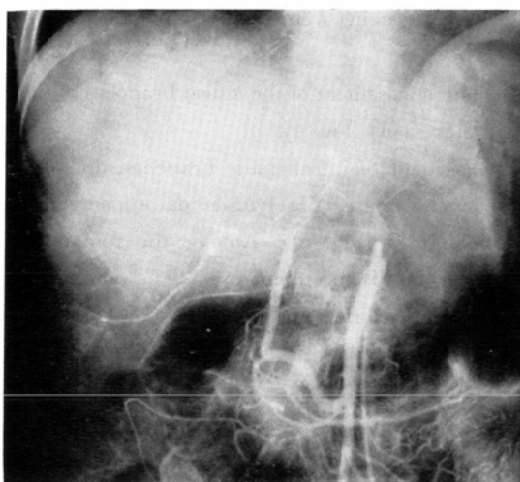Fig. 3. Reticulum cell sarcoma in the ascending colon.

A. Celiac arteriography shows minimal irregularity of gastric mural branches (arrows).

B. Venous phase reveals the densely opacified left gastric vein and gastroepiploic vein (arrows).

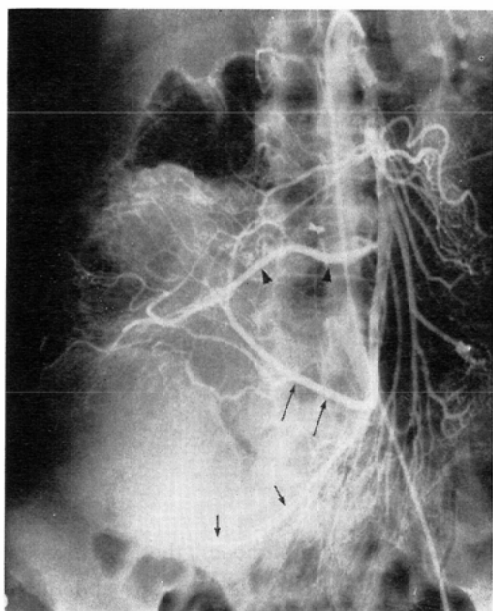Fig. 4. Reticulum cell sarcoma in the stomach.

A. Superior mesenteric arteriography shows the right hepatic artery originating from the superior mesenteric artery. There is displacement and stretching of the hepatic arterial branches and fine neovascularity, indicating masses in the right lobe of the liver.
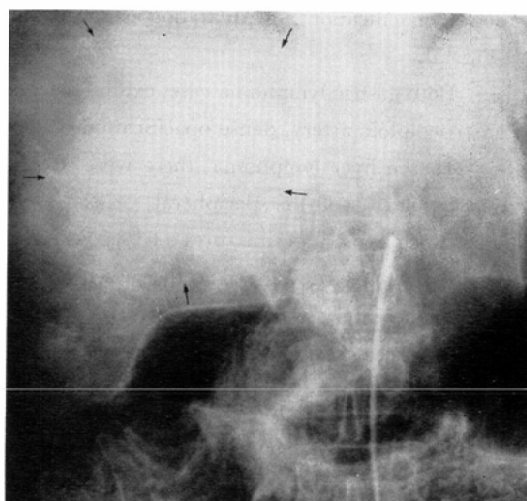
B. The capillary phase reveals intrahepatic masses (region surrounded by arrows), with a mixture of hypovascular zones and tumor stains.

Fig. 5. Lymphosarcoma in the liver.

A. Superior mesenteric arteriography demonstrates displacement and stretching of the ileocecal artery, the right colic artery and the ileal arteries (region surrounded by arrows). Minimal arterial irregularity is seen.
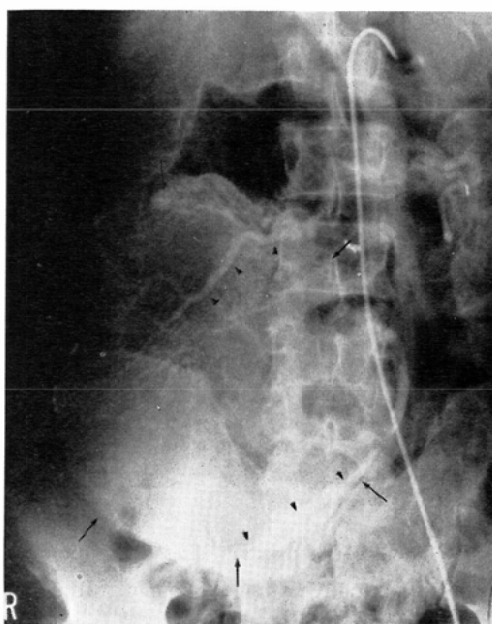
B. The venous phase shows a faint tumor stain (region surrounded by arrows), and densely opacified draining veins (arrowheads).

Fig. 6. Reticulum cell sarcoma in the mesentery.

dense opacification and dilatation of the draining veins. Tumor stains were observed in one patient (Fig. 3).

Both gastric lymphoma cases exhibited slight dilatation and encasement of the mural branches of the gastroepiploic artery, dense opacification of the dilated draining veins (Fig. 4).

In the liver lymphoma, there were stretching and encasement of intrahepatic branches, and fine neovascularity of the peripheral vessels. In the parenchymal phase, the lymphoma appeared as masses composed of mixtures of hypovascular and stained areas (Fig. 5). Among the remaining lymphomas, one developed in the mesentery; the other had peritonitis carcinomatosa. The lymphoma in the mesentery was supplied by the ileocecal and right colic arteries, both of which were dilated. There were encasement of the peripheral branches, but no definite neovascularity. In the capillary phase, the entire tumor was slightly stained; in the venous phase, there were dilatation and dense opacification of the draining veins (Fig. 6). In the peritonitis carcinomatosa patient, there was dilatation of the inferior phrenic and epiploic arteries, with tumor vessels peripherally (Fig. 7).
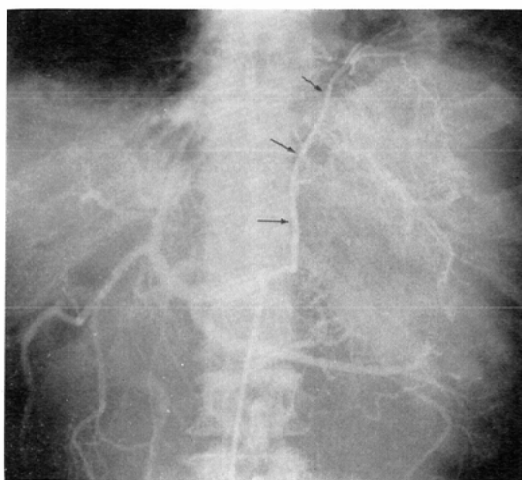

Fig. 7. Peritonitis carcinomatosa due to reticulum cell sarcoma. Celiac arteriography reveals marked dilatation of the left inferior phrenic artery (arrows) and its branches, which provide tumor vessels to the diaphragm and to the peritoneum.

DISCUSSION

Though the primary sites of lymphas are frequently the cervical lymph-nodes, they occasionally develop initially in the abdomen. If a patient known to have lymphoma develops an abdominal abnormality, we can assume any abdominal lesions are due to that lymphoma, providing there is sufficient evidence by tumor scintigraphy or by lymphography. However, if an abdominal lesion is evident in the absence of a known lymphoma, its qualitative diagnosis is difficult by tumor scintigraphy. Using Kinmonth's (4) lymphography and radiological examination of the gastrointestinal tract, it is also difficult to diagnose lesions in the liver and spleen, and in the retroperitoneal and

mesenteric lymph nodes. The paraaortic nodes are exceptions. Angiography is therefore frequently indicated in lymphomas originating in the abdomen.

In their report of the angiographic findings of retroperitoneal lymphomas, Neiman et al. (5) stated that 5 cases of peripancreatic lymphomas were hypovascular masses in which stretching and displacement of the vessels were noted in the peripancreatic area. Among Neiman's 5 cases, encasement was observed in 3, and it was smooth in 2 of these. In their study of 16 cases of retroperitoneal lymphoma, Levin et al. (6) reported that 4 had moderate hypervascularity; 8 were sparsely vascularized and 4 were totally avascular. In the present study, only 2 cases had fine neovascularity in the peripheral portion of the lumbar artery; the remainder were totally avascular. Our findings may have been due to the few cases in which aortography was performed, and because of inadequate visualization of the lumbar arteries feeding the retroperitoneal region.

In three of our 11 cases there was smooth encasement of fairly large arteries. Angiographic findings described by Neiman et al. (5) and ours suggest that arterial caliber irregularity is found in a fair number of lymphomas with so-called "smooth encasement". We observed encasement of the peripancreatic artery in 2 cases, 1 of whom also had occlusion of the splenic vein. Differentiating pancreatic cancer from lymphomas is difficult; however, the paucity of abnormalities in the intrapancreatic branches in our cases may prove to be valuable in distinguishing them. The stretching of arteries in retroperitoneal lymphomas consisted primarily of the so-called "spoke-wheel" displacement of the superior mesentric artery described by Lowman et al. (7).

Jonsson et al. (8) reported that Hodgkin's disease of the spleen presents hypovascular regions in the parenchymal phase, but that this is atypical However, Watanabe et al. (1) encountered 1 case each of reticulum cell sarcoma of the spleen, and lymphosarcoma in which there were avascular regions and arterial encasement. Ekelund et al. (9) found neovascularity and encasement in 2 of 3 cases with reticulum cell sarcoma. All 3 of our cases displayed avascular regions with stretching and encasement of intrasplenic branches corresponding to this region. Two had fine neovascularity. Our findings agreed well with those reported by Ekelund et al. (9).

Among 5 cases of lymphomas of the gastrointestinal tract, Watanabe et al. (1) found tumor stains in 2 and early venous filling in 4. Okazaki et al. (2) found hypervascularity with tumor vessels and stains, and encasement of the vasa recta in their case of reticulum cell sarcoma of the ileocecal region. They therefore claimed that angiography is indispensable in the diagnosis of lymphoma. In 4 cases of reticulum cell sarcoma of the small bowel, Lunderquist et al. (3) found only 1 case with dilatation of the ileocecal artery and stretching of the vasa recta, allegedly negating the diagnostic significance of angiography. In our 5 cases of reticulum cell sarcoma of the gastrointestinal tract, 2 in the stomach and 3 in the large bowel, dilatation and encasement of the mural branches and dense opacification of the draining veins were common in all cases. Our findings in reticulum cell sarcoma of the ascending colon were nearly identical with those reported by Okazaki et al. (2); and dense tumor stains were observed in the capillary phase. Our findings of dilatation of the feeding arteries and dense opacification of the draining veins indicate that lymphomas of the gastrointestinal tract are not necessarily totally avascular. Because of this, differentiation of lymphomas from cancer may at times be difficult.

The 2 cases of Hodgkin's disease of the liver repirted by Chuang et al. (10) were both hypovascular

masses.　However, the case of lymphoma with marked tumor stains, reported by Castañeda-Zuñiga et al. (11) prompted them to conclude that it is difficult to differentiate hypervascular metastatic liver cancer from lymphoma.　The cases of lymphosarcoma of the liver we encountered had fine neovascularity and encasement of the hepatic arterial branches with a mixture of hypovascular and stained areas in the parenchymal phase.　In these cases, it is necessary to include in the differential diagnosis intraphepatic cholangiocarcinoma and metastatic liver tumor.　Since intrahepatic cholangiocarcinoma often develops in the liver hilum, because of its infiltrative growth, the differential diagnosis should be based in findings such as the presence of encasement of the comparatively large intrahepatic arteries in the liver hilum and a lack of stretching and displacement of arteries.　The differential diagnosis of metastatic liver tumor may be a problem when it is the type of lymphoma that forms multiple nodules. But as Castañeda-Zuñiga et al. (11) stated, they are difficult to distinguish.

All 3 cases of lymphoma of the mesentery reported by Diamond et al. (12) were hypovascular tumors and all had stretching and encasement of vessels.　Since our case had minimal tumor stains and dense opacification of the draining veins, it was not particularly hypovascular.　There was marked vascularity in the case of peritonitis carcinomatosa.

In our experience, the characteristic manifestations of lymphoma of the liver, gastrointestinal tract, mesentery and peritoneum differed somewhat from those previously reported.　We should realize that tumors are not entirely avascular, and that they sometimes have neovascularity and marked tumor stains.　Also, in splenic lymphomas, though the tumor itself may be avascular, not infrequently there may be fine neovascularity in the regions surrounding it.　If it were possible to visualize all the arteries supplying lymphomas in the retroperitoneal region, it should be possible to detect tumors with some degrees of vascularity with fairly high frequency, even though it might not be possible to observe the marked tumor vascularity reported by Levin et al. (6).　However, even when vascularity is present in abdominal lymphomas, the degree of tumor vascularity and arteriovenous shunting is not as great as in hepatomas and hypernephromas.

Vascularity in parenchymal organs such as the liver and spleen is a fine neovascularity; in hollow organs, such as those of the gastrointestinal tract, it consists of dilatation of the feeding arteries and dense opacification of the draining veins.　Encasement of arteries was observed in all cases with involvement of the spleen, liver and gastrointestinal tract.　This is one of the most important qualitative diagnostic points in lymphomas.　Encasement of the proximal portion of the common hepatic, splenic or superior mesenteric arteries may be mistaken for spasm due to catheter manipulation although the latter is usually demonstrated as local constriction rather than smooth narrowing of the vessels.　The mistake can be avoided by obtaining the aortogram initially.

CONCLUSION

The angiographic findings of 22 abdominal lymphomas, including 11 of the retroperitoneal region, 3 of the spleen, 3 of the large bowel, 2 of the stomach, and 1 each of the liver, mesentery and peritoneum, were reviewed.

Contrary to some previous reports, abdominal lymphomas are not avascular tumors.　We found many cases with fine neovascularity in the parenchymal organs and that there were dilatation of feeding

arteries and dense opacification of draining veins in hollow organs. Encasement of arteries was an important finding in making a qualitative diagnosis of lymphoma.

ACKNOWLEDGMENT

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