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Liposarcoma

A Study of 103 Cases

By

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With 16 Figures in the Text

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Among mesenchymal tumors, liposarcomas are probably unsurpassed by their wide range in structure and behavior. In fact, the variations are so striking that it seems more apt to regard them as groups of closely related tumors rather than a well-defined single entity. Since liposarcomas may range from frankly malignant tumors to borderline cases of low-grade malignancy, careful histologic classification is mandatory for determining prognosis and selection of the proper type of therapy. Although considered rare, the liposarcoma is the most common malignant mesenchymal tumor of adults coded at the Armed Forces Institute of Pathology. By mid-1961, there were over 500 liposarcomas among the more than 1,000,000 general accessions in the files of the Armed Forces Institute of Pathology.

The astounding size of many liposarcomas instigated a considerable number of early case reports. Examples weighing in excess of 50 lb. are not particularly rare.

Several tumors of such size have been reported, and several are present in our material. VIRCHOW (2) was among the first to make a detailed report; in 1865 he described a huge liposarcoma of the leg of 20 years' duration. In the same issue of Virchow's Archiv, WALDEYER reported a 63-lb. liposarcoma of the abdomen. More than others, these reports stimulated considerable interest in this entity, and in 1916 ROBERTSON was able to collect 50 liposarcomas from the literature. Since then this number has been multiplied several times. EWING'S (1) discussion and STOUT'S (1) review and analysis of 41 cases constitute probably the two most important and influential contributions since VIRCHOW'S time. For other detailed discussions of this entity the reader is referred to the papers by DE WEERD and DOCKERTY; ENTERLINE et al.; PACK and PIERSON; and VON WAHLENDORF.

Like other soft tissue tumors, liposarcomas show a preference for certain locations. Little is known, however, about the influence of different anatomic sites upon histology and behavior. To regard liposarcoma as a tumor of adult adipose tissue would be erroneous. In fact, it is found only rarely in areas where normally most of the body fat is stored. It should rather be considered as a tumor of the large connective tissue spaces in which the cells have retained their potential for lipogenesis. The principal sites for such tissue, therefore, are chiefly the intermuscular gliding spaces and the perivascular and subcoelomic regions. In our material, the majority of liposarcomas were found in three distinct locations: first, the lower extremity, particularly the popliteal fossa and medial thigh; second, the retroperitoneal, perirenal, and mesenteric region; and third and finally, the shoulder area.

The present report is a comparative study of 103 liposarcomas exclusively from the lower extremity and retroperitoneum. Its purpose is to give an account of clinical behavior and morphology of the various types and to compare and correlate the available data of the two sites with the largest number of cases. Furthermore, consideration will be given to the question of multicentric liposarcomas and to the disputed origin of liposarcomas from lipomas; the close morphologic and histologic relationship between preadipose tissue and many liposarcomas will be emphasized also.

After a preliminary study of liposarcomas from other sites, it is felt that this sample, though limited in many of its aspects, will be fairly representative of the entire group of liposarcomas.

Material and Methods

Of some 450 liposarcomas on file at the Armed Forces Institute of Pathology, only those of the two most common sites, the retroperitoneum and the lower extremity, were used for this report. After review of the entire histologic material, 103 cases were selected. All of these cases had been submitted for consultation by Armed Forces laboratories and civilian contributors. Of these tumors, 59 were located in the lower extremity and 44 in the retroperitoneum. For comparison, 19 lipomas of the retroperitoneum were reviewed. A large number of cases originally coded as liposarcomas were not included in this series because of inadequate or unconvincing clinical or pathologic data. Of the acceptable cases, all data are based on a review of the histologic material and the available clinical histories.

In all instances hematoxylin and eosin-stained sections were available for examination. In some, additional sections were prepared from the wet tissue. Histochemical procedures used were Snook's reticulum stain, the periodic acid-Schiff (PAS) reaction with and without diastase, Masson's trichrome stain, and oil red O (ORO) stain.

The mucopolysaccharide content of the tumors was studied by the Mowry modification of the Hale colloidal iron stain (AMP) and alcian blue stain before and after digestion with testicular hyaluronidase. Metachromasia was tested with toluidine blue and cresyl violet stains.

Age and sex. Liposarcoma is primarily a tumor of *adult life*. The mean age of all our patients was 51 years. The youngest was 20 years, the oldest 80 years. STOUT (1) reported a mean age of 53 years, DE WEERD and DOCKERTY extremes of 24 and 68 years. In our material the age could be closely related to both tumor site and histologic type. Thus, patients with tumors of the lower extremity were considerably younger than those with tumors of the retroperitoneum (Table 1). For instance, one-half of the patients with tumors of the lower extremity were less than 42 years of age, while one-half of those with tumors of the retroperitoneum were 55 years or more. This statistically significant difference seems to be caused mainly by the relatively late detection of the retroperitoneal tumors and less by the variation in tumor type. The latter point is well illustrated by the fact that if the median ages of only one single histologic type are compared, this age difference between both anatomic sites is still apparent: myxoid liposarcomas — lower extremity 39 years, retroperitoneum 60 years (Table 2).

Comparison of age and histologic type was also of some interest. Thus, patients with myxoid and round cell liposarcomas were considerably younger than those with well-differentiated and pleomorphic types. The respective data are given in Table 2.

Liposarcomas in children are, in our experience, exceedingly rare, and such a diagnosis should be made with caution. One tumor in a 6-year-old child originally diagnosed as myxoid

liposarcoma was excluded from this series because on later review it was considered to represent a fetal lipoma. This patient was well and without recurrence 7 years after excision. Cases of congenital lipomatosis and probable lipoblastomatosis (VELLIOS) also were omitted, though differentiation from liposarcomas may at times prove difficult. In the literature the rarity of liposarcomas in children is well recognized, though several cases are on record (KAUFFMAN and STOUT; ENTERLINE et al.).

While the age incidence of liposarcomas follows closely that of lipomas (ADAIR), their sex incidence differs substantially. Unlike lipomas, in which at least two-thirds of all tumors occur in females (ADAIR), liposarcomas generally show a slight preference for the male sex [STOUT (1); DE WEERD and DOCKERTY]. In our material, which is derived in large part from military sources, this preference for the male sex (84 male, 19 female) is obviously of little significance. If patients from civilian sources alone were considered, however, this tendency was clearly maintained (20 male, 15 female). Neither in our material nor in the literature was there any evidence of preference for certain ethnic groups, and distribution between whites and negroes was fully proportional to the over-all distribution in the AFIP material. A distinct hereditary or endocrine pattern, as sometimes reported in lipomas, was not seen.

Table 1
Liposarcomas: Age Distribution According to Tumor Site

Age in years Decade	Retroperitoneum %	Lower extremity %
20—29	—	15
30—39	13	28
40—49	16	24
50—59	34	15
60—69	30	12
70—79	7	4
80—89	—	2

Table 2. *Liposarcomas: Median Age According to Tumor Type and Site*

Tumor type	Total Yr.	Retroperitoneum Yr.	Lower extremity Yr.
Myxoid	41	60	39
Round cell	41	51	40
Well-differentiated	47	52	38
Pleomorphic	58	59	57
Median age of all patients	48	55	41

Table 3. *Liposarcomas: Symptoms and Signs, by Tumor Site*

Symptom or sign	No. of patients
Lower extremity:	
Painless mass	52
Pain	7
Pitting edema	3
Retroperitoneum:	
Abdominal enlargement	23
Weight loss	16
Abdominal pain	12
Palpable mass	9
Hernia	8
Weakness, malaise	8
Pitting edema	7
Nausea, vomiting	6
Fullness after meals	5
Constipation	4
Diarrhea	2
Ascites	2
Respiratory distress	2

Symptoms and signs. Accurate preoperative diagnosis was virtually impossible, since clinical symptoms were nonspecific and depended largely upon site and size of the tumor. The symptoms were indistinguishable from those of any other large, space-occupying tumor. Most of the symptoms were caused either by displacement of nerves and vessels or by compression of urinary and intestinal structures.

A fairly well-circumscribed palpable mass, slowly increasing in size over many months, was the first manifestation in almost all patients with tumors in the lower extremity (52 of 59). In seven, the mass was painful, but pain was generally mild or of moderate severity, even when the tumor was closely attached to nerves. Pain on palpation or pressure, as often seen in angiolipomas (HOWARD and HELWIG), was not noted. In three patients a large tumor of the thigh caused pitting edema of the lower extremities (Table 3).

Diffuse and gradual abdominal enlargement was the first symptom in 23 of the 44 patients with retroperitoneal tumors, and in most of these a mass was palpable. The abdomen was

tender or painful in 12 patients, but, as in the lower extremity, pain was rarely severe. Onset of sudden severe pain was more often encountered in large abdominal lipomas than in liposarcomas. Sixteen patients noted weight loss. It is remarkable that the large amounts of lipid in the tumors could not be utilized and were unavailable for general metabolism. The contrast between emaciation and a large, fat-bearing tumor was often striking. Weakness, fatigue, and lassitude were common. In eight patients an inguinal hernia heralded the enlarging abdominal tumor, and in seven venous compression led to pitting edema of the lower extremities. Nausea and vomiting were reported in six patients, constipation in four (Table 3).

Disturbance of renal function was associated with the majority of retroperitoneal tumors. Most often, the growing tumor displaced kidney and ureters anteriorly, and malrotation and displacement were demonstrable early on retrograde or intravenous pyelograms. Hydronephrosis, pyelonephritis, and uremia, as sequelae of urinary obstruction, were common. Intermittent chills and fever were probably caused by infection, hemorrhage, or necrosis. Erosion of vascular structures was not seen.

Location and gross appearance. In the lower extremity, the tumors occurred at any site, but showed a definite preference for popliteal fossa and medial thigh. More than half of all tumors (33) came from these two locations. Three tumors each originated in buttocks and lower legs. One arose from the foot. The remaining 19 came from various other portions of the thigh. The large size of many tumors and the local extensions frequently prevented determination of the exact site of origin. The upper portion of the popliteal fossa, however, and areas adjacent to Hunter's canal were sites particularly preferred. Awareness of the relative rarity of liposarcomas in hands and feet may be of considerable aid in differential diagnosis.

The most common retroperitoneal location was the perirenal region. The fact that the kidney was usually pushed forward and medially by the expanding tumor suggested origin from retrorenal tissues. The tumor was generally intimately attached to a psoas muscle or renal capsule. Invasion of renal parenchyma was not seen, but compression of renal pelvis and ureter were common complications. A few tumors extended from the retroperitoneum into the mesentery or, growing beneath the parietal peritoneum, invaded the lateral and anterior abdominal wall. In a few instances, this mass in the abdominal wall was the sole manifestation of a silent retroperitoneal liposarcoma. Multiple and apparently independent tumors in retroperitoneum, mesentery, and omentum were described in several instances. Origin in the pelvis is apparently rare and was seen only in two patients, but a pelvic tumor extending from buttocks was encountered twice.

For reasons unknown, there was some preference as to right and left side in the two anatomic locations. Thus, 37 of 57 tumors of the lower extremity in which the site was given occurred on the right side. Yet, in the retroperitoneum, where the primary tumors were usually limited to one side, the left side was more frequently involved (19 left, 11 right). DE WEERD and DOCKERTY state a similar prevalence of retroperitoneal liposarcomas on the left side.

Characteristically almost all of the tumors were deep seated, and the majority seemed to take origin from large connective tissue spaces between muscles and along vessels and nerves. Growth within muscles confined by perimysial sheath was observed, but was generally limited to recurrent tumors. The fact that one of the tumors was reported as having been attached to the periosteum by a small pedicle and that in several others the sciatic nerve was spread over the tumor testifies to their deep location.

From our material and from the data in the literature, there is little doubt that origin in the subcutis is exceedingly rare. Generally, most liposarcomas have reached considerable size before they encroach upon subcutaneous tissue. Noteworthy exceptions are the shoulder, neck, and face region, where tumors of smaller size and short duration may extend into subcutaneous fat. In our series, only one tumor was of a more superficial location. It arose from the fossa ovalis and was closely adherent to both femoral vessels and skin. Nor is there any evidence that liposarcomas are more prevalent in areas of excessive fat storage or among the obese.

The large bulk of most liposarcomas has been emphasized in many of the earlier descriptions. DELAMATER's patient, in whom an alleged abdominal liposarcoma reached 275 lb., is cited frequently. WELLS, ROBERTSON, WALDEYER, and others report liposarcomas of 60 lb. and more.

In our material the *mean weight* of 24 retroperitoneal liposarcomas was 7,890 g; the mean largest diameter of these tumors was 22 cm. Generally, tumors of the extremities were considerably smaller than those of the retroperitoneum; exceptionally large tumors are seen occasionally, however. For example, the largest of our liposarcomas of the lower extremity weighed 6,000 g and measured 48 cm in largest diameter. The mean weight of 40 liposarcomas of the leg was 1,640 g, the mean diameter 11.2 cm. Since data are more apt to be given on tumors of unusual size and weight, the true over-all average is probably less than the above figures.

The *gross appearance* varied markedly, depending upon histologic type and relative amounts of myxoid material, vascularization, fat, and fibrous elements. Generally, the tumor consisted of smooth, lobulated, or nodular masses. In most instances it was encapsulated and freely movable and could be shelled out easily from surrounding tissues. This apparent circumscription may be misleading, however, since daughter nodules about the main tumor mass are common. Both incomplete excision and laceration of the thin tumor capsule probably account for a good many local recurrences; for adequate treatment, therefore, it is mandatory that the tumor be widely excised, with a good margin of healthy tissue. Recurrent tumors were often ill defined and less well encapsulated. Inaccessibility or intimate association with vital structures often thwarted complete excision.

On section, fine fibrous septa were found to divide the tumors into distinct small lobules. Consistency and color of the tumors varied considerably with the histologic type. The jelly-like, moist, glistening appearance of myxoid tumors was often associated with the lipoma-like features of the well-differentiated type, while some of the round cell and pleomorphic tumors were marked by their more brainlike quality. The cut surfaces ranged in color from greyish-white to different shades of red and yellow, again depending entirely upon tumor constituents.

Retrogressive changes were common but varied somewhat with tumor type. Areas of necrosis and fresh and old hemorrhage were especially prominent in myxoid tumors. Cystic change or fibrosis was often seen without particular preference for any tumor type; in some instances they followed x-ray therapy. As expected, retrogressive changes were least conspicuous in the slow-growing

and well-differentiated liposarcomas. Unlike the case in lipomas, calcification and ossification were uncommon and were seen only in one tumor each. Cartilaginous metaplasia was encountered in several instances, however.

Microscopic Classification

In their better differentiated forms, liposarcomas reflect with surprising accuracy varying stages in the development of normal fat. This histologic resemblance to early adipose tissue is further emphasized histochemically by similar staining reactions and the close relationship between acid mucopolysaccharides and lipogenesis.

In their less differentiated forms, liposarcomas may mimic a variety of tumors, and in the absence of lipogenesis recognition may become exceedingly difficult.

Classification of many of our tumors was greatly facilitated by a remarkably uniform pattern. In many others, however, transformations from one type to another complicated identification. Study of a large number of sections is therefore necessary before classification is attempted. In our material, those tumors that were composed of a variety of patterns were classified according to their least differentiated element.

Although several types of liposarcoma have been described in detail by early investigators, accurate over-all classification was frequently hampered by the limited number of available cases. Also, the same tumor type has often been described by diverse authors under a confusing variety of names. For instance, VIRCHOW'S (2) myxoma lipomatodes malignum, BUROW'S sarcomatous telangiectatic myxolipoma, EWING'S and HARRISON'S mesenchymoma, GRICOUROFF'S embryonal liposarcoma, and EWING'S (2) myxoid liposarcoma are terms that had been employed synonymously for one tumor type. Since many liposarcomas of various histologic pattern may contain myxoid elements GRICOUROFF'S term of embryonal liposarcoma has much merit. In the present paper, EWING'S (1) and STOUT'S (1) work served as a basis for our classification.

EWING (1) separated liposarcomas into adult, myxoid, and granular cell types, relating the last group to brown fat. STOUT (1), reporting 41 liposarcomas, amplified EWING'S (1) classification and divided liposarcomas into four classes: (1) well-differentiated myxoid type; (2) poorly differentiated myxoid type; (3) round cell or adenoid type, and finally (4) a mixed group. ENTERLINE et al. adhered to most of this classification, but added a well-differentiated lipomalike type and a nonmyxoid type; in the latter they included round cell tumors and tumors with spindle cell and pleomorphic features.

In this report classification was simplified, particularly because it was felt that further subdivisions are justified only if they are of significance for the clinical behavior and treatment. For the purpose of this paper liposarcomas were divided into four groups: (1) myxoid type; (2) round cell type; (3) well-differentiated, adult type; and (4) pleomorphic type. Since round cell liposarcomas are rarely of a pure type, those tumors that contained both round cell and myxoid features were also included within this group. Moreover, STOUT'S (1) second class, the poorly differentiated myxoid tumors, was combined with other nonmyxoid and poorly differentiated tumors into one single category. It was believed that combining these two forms was permissible in this report since in our material both types pursued an essentially similar clinical course.

Histology

Myxoid type. Undoubtedly this is by far the most common form of liposarcoma. It is the most frequently described type in the literature and was prevalent in almost half (46%) of our tumors; we found it three times more common in the lower extremity than in the retroperitoneum (Table 4). The type was also more frequent in males than in females. In most instances, the entire tumor showed a uniformly myxoid pattern; yet, occasionally transitions to all other forms of liposarcoma could be observed.

Table 4. *Liposarcomas: Anatomic Distribution of Histologic Types*

Histologic type	Total no.	Anatomic distribution	
		Lower extremity	Retroperitoneum
Myxoid	47	35 (74%)	12 (26%)
Round cell	13	10 (77%)	3 (23%)
Well-differentiated	16	4 (25%)	12 (75%)
Pleomorphic . . .	27	10 (37%)	17 (63%)

Comparison of individual myxoid tumors discloses a considerable morphoiogic range. Recognition of these variants, however, is greatly facilitated by their close structural and histochemical resemblance to successive stages in the development of normal fat. In fact, WASSERMANN's detailed description of the changes in primitive fat organs might serve as an accurate blueprint for the morphology of the myxoid type (Fig. 1).

As in the primitive fat organ, the tumor is composed of three main elements: (1) proliferating lipoblasts in various stages of differentiation; (2) a delicate plexiform capillary pattern; and in between (3) a myxoid matrix containing abundant hyaluronidase-sensitive acid mucopolysaccharides (Fig. 2).

Although these three are described separately, this should not distract from the fact that all three form an inseparable and interdependent system. Cellular proliferation and capillaries as well as lipid formation and mucopolysaccharides are intimately linked together. Angiolipomas and myxolipomas constitute similar and benign parallels to this close relationship.

Fig. 1. Fetal fat from fetus 23 cm, 380 g, approximately 18 weeks' gestation. This histologic pattern is simulated by myxoid liposarcoma. Compare with Fig. 2. Hematoxylin and eosin. Mag 305 ×. AFIP Neg. 61-5432

In their most primitive form the great majority of proliferating cells cannot be distinguished from primitive mesenchyme. Because of this, myxoid liposarcomas have been interpreted by some as mesenchymomas (EWING and HARRISON; GILMOUR). Such an interpretation, however, would necessarily imply that these cells have retained the multipotential capacity of primitive mesenchyme.

Judging from our material, the capacity for multiple differentiation is sharply limited, and it seems more likely that the purely mesenchymal portion of this tumor has already progressed to a one-sided differentiation and that only little leeway is left for differentiation in other directions. In other words, lipoblastic determination of the perivascular mesenchyme seems to precede its morphologic manifestation.

Even in tumors that appear purely embryonal, occasional lipid deposition can be detected. As in fetal fat, however, the degree of lipogenesis varies con-

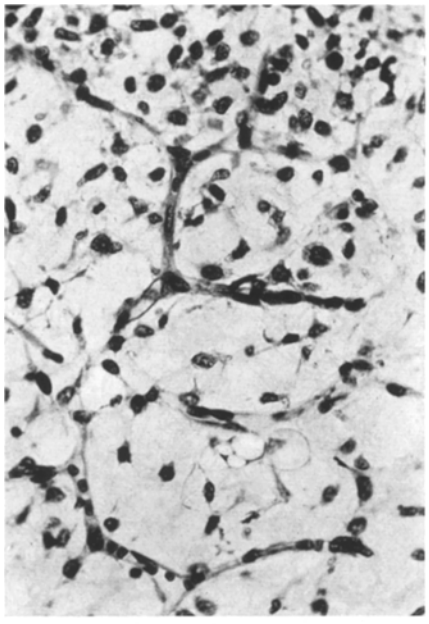

Fig. 2

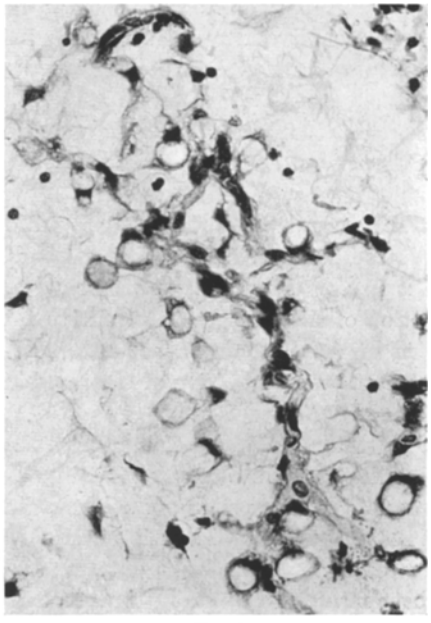

Fig. 3

Fig. 2. Myxoid liposarcoma, consisting chiefly of undifferentiated cells with little lipogenesis. Note resemblance to fetal and atrophic fat (Figs. 1 and 3). Hematoxylin and eosin. Mag. 305 ×. AFIP Neg. 61-5005

Fig. 3. Atrophic fat. Note resemblance to myxoid liposarcoma and fetal fat (Figs. 2 and 1). Hematoxylin and eosin. Mag. 305 ×. AFIP Neg. 61-4978

siderably. In the most primitive areas, the cell boundaries are still indistinct. Only in silver preparations can long and slender processes be seen, forming a spongelike or pseudosyncytial arrangement; interestingly, many of these cells are intimately attached to capillaries, and clear distinction from capillary endothelial cells is not always possible. The stellate configuration of cells and their pseudosyncytial arrangement is best seen when finely dispersed droplets of lipid material begin to fill the cytoplasm (Fig. 7). With enlargement and fusion of these droplets the cells become more rounded, yet they still remain attached to each other by delicate argyrophilic processes. With further lipid deposition the lipoblasts approach the picture of mature adult fat cells. As in adult fat, the plump nuclei, originally centrally located, are crowded to the periphery and become deformed. Unlike the picture in adult fat, however, "Lochkerne" are rarely seen (PLAUT). Large multivacuolated lipoblasts and giant cells occur occasionally and should be considered as a tendency toward more malignant

forms. The almost complete absence of mitotic figures is a constant and particularly remarkable feature.

The nutritional importance of the capillary network is probably secondary to its function as growth center. Generally, lipid was deposited at random and was as pronounced in poorly vascularized areas as in the vicinity of vessels. In some instances it even appeared as if more fat had been deposited distant to the vascular supply. Occasionally an increase of lipid-carrying cells was noted in the subcapsular zone.

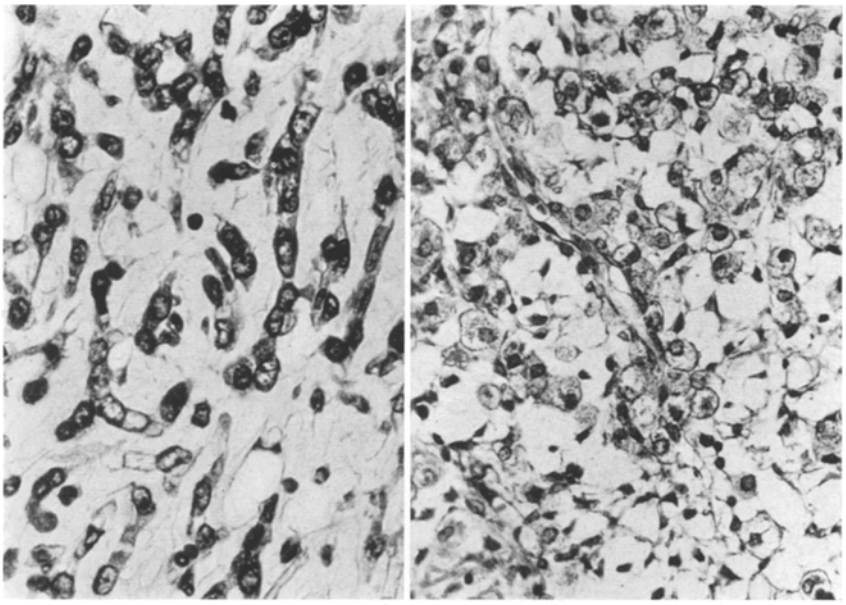

Fig. 4 Fig. 5

Fig. 4. Myxoid liposarcoma. Transitions to the round cell form of liposarcoma. Hematoxylin and eosin. Mag. 350 ×. AFIP Neg. 61-5013

Fig. 5. Myxoid liposarcoma with early formation of round cell pattern. Hematoxylin and eosin. Mag. 485 ×. AFIP Neg. 61-5004

The maze of capillaries is one of the most distinct features of the myxoid form, and the early description of this tumor as lipoma myxomatodes telangiectaticum (BUROW) is not surprising. In fact, FLEMMING'S statement that the "entire adipose tissue is a loosened adventitia" is recalled by this pattern (Fig. 8). As a rule, the rich network of capillaries is most prominent in those tumors in which the cells retain their primitive appearance. Conversely, in tumors that contain a large number of maturing lipoblasts, the plexiform capillary pattern is less pronounced. Also, the vascular pattern may at times become obscured by an excessive number of cells or by fibrosis. On the other hand, occasional foci of telangiectasia may imitate closely an angiomatous pattern. Nevertheless, large vessels are rare, and the plexiform vascular bed consists almost entirely of capillaries of uniform and small caliber. Occasionally, foci with less distinct capillary formation occur and might be mistaken for myxomas.

The amount and distribution of the characteristic myxoid material varied considerably from tumor to tumor. It was present primarily in extracellular

compartments but was encountered also within cells. In some tumors the extracellular material formed large pools and often bestowed a cribriform, lacelike pattern to the tumor. On occasion, cellular proliferation at the margin of these pools produced a pseudoglandular pattern (Fig. 9). In others, loss of staining power of the accumulated material and endotheliumlike arrangement of the adjacent tumor cells mimicked lymphangiomatous spaces. While a loose, haphazardly arranged network of delicate reticulum fibers was almost always present within the myxoid material, thick and birefringent collagen fibers were practi-

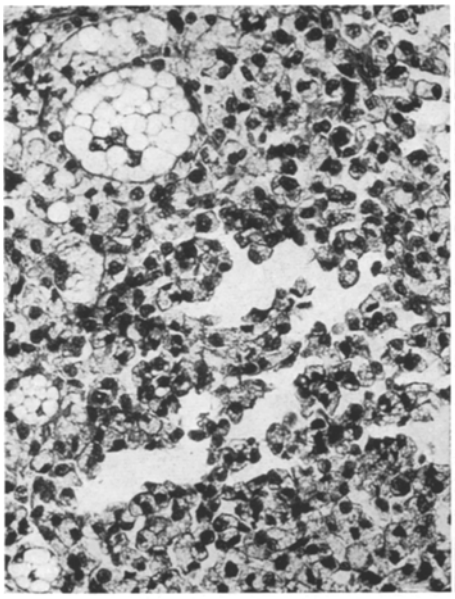

Fig. 6

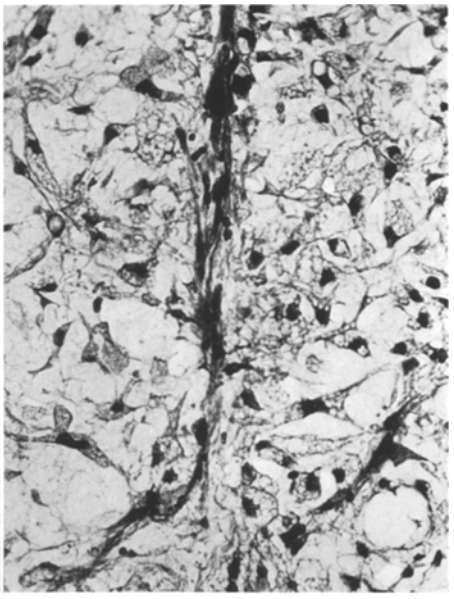

Fig. 7

Fig. 6. Round cell liposarcoma with large, multivacuolated lipoblast in the upper left of the picture. Hematoxylin and eosin. Mag. 180 ×. AFIP Neg. 60-2939

Fig. 7. Lipid deposition in myxoid liposarcoma. The lipoblasts are still arranged in pseudosyncytial pattern. Hematoxylin and eosin. Mag. 220 ×. AFIP Neg. 61-5430

cally never seen. The delicate reticulin fibrils generally showed no particular orientation except along vessels and about fat droplets. The latter were usually suspended in their reticulin meshwork like balloons in a net (Fig. 8).

In some tumors areas showing a distinct spindle cell pattern were present. Unlike the spindle cells of the pleomorphic type, however, the cells were small and slender and generally orientated along a single plane. As a rule the cytoplasmic boundaries of these cells were poorly defined and blended with the rich reticulin meshwork of the stroma.

In four instances foci of cartilaginous metaplasia were present. In all of these there was a gradual change between liposarcoma and cartilage. The alteration of the matrix was brought out best in those sections stained for acid mucopolysaccharides in which the intercellular matrix in and about cartilaginous foci lost its sensitivity to hyaluronidase digestion.

The extramedullary hematopoiesis occasionally encountered in lipomas was not a feature in our tumors. Inflammatory cells were often present, but in most

instances the inflammatory component was negligible. Yet, small foci of lymphocytes and scattered plasma cells were noted in most tumors.

Most myxoid liposarcomas maintained a surprisingly uniform pattern, even after treatment and after several recurrences. In two instances, however, it appeared as if fibrosis had been stimulated by irradiation. In others, changes toward the round cell type occurred (Fig. 5). This indicates that in every case of myxoid liposarcoma, prognosis ought to be rendered with caution, particularly if only one or two sections have been examined.

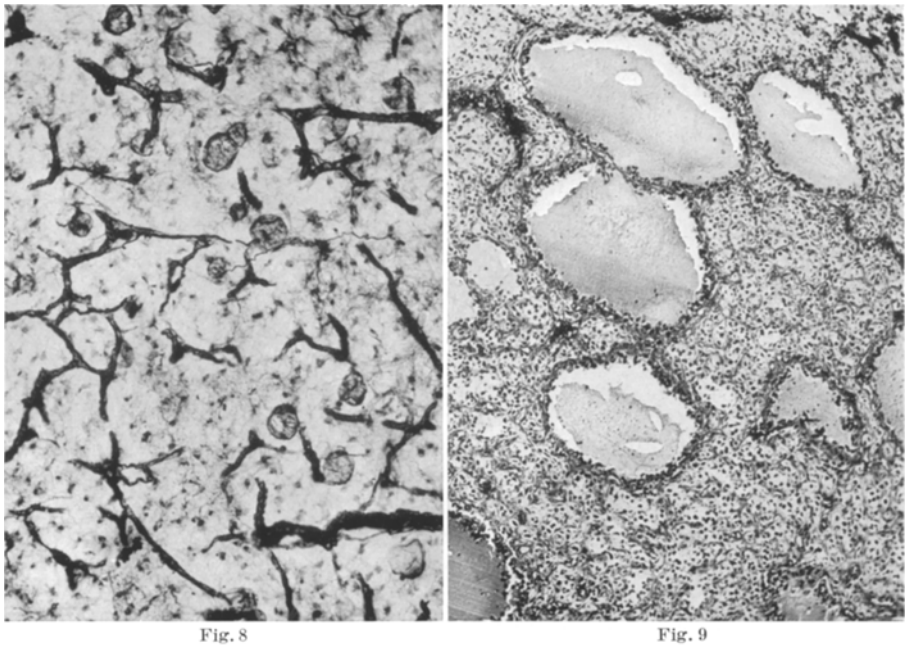

Fig. 8 Fig. 9

Fig. 8. Myxoid liposarcoma. Thick section showing reticulin meshwork about plexiform capillaries and lipoblasts. Snook's reticulum. 20 μ section. Mag. 115 ×. AFIP Neg. 60-2950

Fig. 9. Mucoid pool with peripheral condensation of cells, forming a pseudoglandular pattern. (Myxoid liposarcoma.) Hematoxylin and eosin. Mag. 350 ×. AFIP Neg. 60-1915

Round cell type. Although this type is closely related to the myxoid form, it deserves separate consideration because of its aggressive clinical course and the frequency of metastasis.

The close relationship to myxoid tumors is well expressed by its anatomic distribution. Of 13 tumors so classified, 10 arose in the lower extremity and 3 in the retroperitoneum (Table 4). The histologic pattern was generally less uniform than in the myxoid type. Focal myxoid features occurred in slightly more than one-half (seven) of the cases.

In the great majority, the main characteristic was an excessive proliferation of uniform and rounded cells. Lipid formation was greatly inhibited, and there was little intercellular myxoid material. The vascular structures were less prominent or were obscured by the great number of cells. Nevertheless, in some tumors the cells were arranged in branching rows and strands along abortive

capillaries, resulting in a somewhat trabecular and "adenoid" appearance (Fig. 4). In fact, the expressions "'adenoid' type" and "round cell type" have been used interchangeably in describing these tumors [EWING (1), STOUT (1)].

In our material two variants could be distinguished: in one, fairly uniform round nuclei were surrounded by considerable finely stippled and well-demarcated cytoplasm. The large, pale polyhedral cells often bestowed a "hypernephroid" appearance to the tumor (Fig. 6). In another variant, more irregular nuclei without precise cellular boundaries were set into an acidophilic matrix. ORO-positive material was usually scarce, more so in the second variant than in the first. Generally, only a few scattered lipoblasts provided telltale evidence of the pathogenesis (Fig. 6). As in the myxoid form, mitotic figures were exceedingly rare, even in the most cellular tumors; evidence of hemorrhage and necrosis was not increased over the myxoid form. EWING (1) conceived of the round cell type as the malignant counterpart of a hibernoma. Location and frequent transitions to other forms seem not to support this concept, however, but rather suggest that it is a less differentiated modification of the myxoid form in which the cells are largely incapable of lipid formation.

Well-differentiated adult type. The difficulty of distinguishing some well-differentiated liposarcomas from deep-seated and poorly circumscribed lipomas has been repeatedly pointed out [EWING (1); DE WEERD and DOCKERTY; SHUMAN; STOUT (2); TEDESCHI; VON WAHLENDORF]. For instance, EWING (2) described one tumor that recurred many times in the course of 15 years and still was made up entirely of mature-appearing fat. In one of our cases (AFIP 813156) a similar tumor of the neck recurred 15 times within a period of 31 years. Most sections were indistinguishable from those of ordinary lipomas. Errors in diagnosis are particularly frequent in fatty tumors of retroperitoneum and muscle. Often only a large number of sections and careful consideration of growth features will allow differentiation. It is fortunate that this class of liposarcoma follows a relatively benign course and is not likely to metastasize. Still, its high recurrence rate and aggressive infiltrative growth make clear distinction desirable.

In our material, the well-differentiated type was uncommon in the lower extremity; 12 out of 16 examples were located in the retroperitoneum. The average age was somewhat higher than that of the first and second groups.

Histologically, two modifications of the well-differentiated form could be distinguished: first, a well-differentiated "lipoma-like" form, and second, a well-differentiated sclerosing type. The first form simulated closely mature adipose tissue, except for some cellular pleomorphism and occasional lipoblasts. Only tumors in which at least one section showed these changes were selected for this group. An erroneous diagnosis of lipoma was frequent in this class. The second modification exhibited a much more distinct and easily recognizable pattern in which lipoma-like portions alternated with areas of dense fibrosis. In the latter, giant lipoblasts containing lipid and mucoid material were common (Fig. 10). It is noteworthy that all our examples of the sclerosing form came from the retroperitoneum and with one exception occurred in women. Lipomas showing thick bundles of collagen and, less frequently, an admixture of smooth muscle or angiomatous elements must be separated from this group.

In some examples, usually only in a few portions, mucoid matrix was abundant and the pattern approached that of a more mature myxoid form. Transitions to the round cell and pleomorphic types were not observed.

Since cases of congenital diffuse lipomatosis, which are often associated with osseous malformations, follow a benign course and tend toward spontaneous regression, these tumors were excluded from this group. KRETSCHMER's case of a liposarcoma occurring in a child may represent this entity.

Pleomorphic type. Although by no means rare, this is probably the least frequently recognized of all liposarcomas. In our series a majority (63%) of the 27 examples were located in the retroperitoneum; 10, or 37%, arose in the lower extremity (Table 4).

Because of a common behavioral pattern, two related but distinguishable forms were combined into this group. Outstanding and characteristic features of both were a disorderly growth pattern, an extreme degree of cellular pleomorphism, and bizarre giant cells. Both differed considerably, however, in their content of lipid and mucoid material. In some tumors, the most characteristic features were large giant cells with numerous lipid droplets of varying size bestowing to the cells a grapelike or moruloid appearance. The nuclei were distinct and hyperchromatic, and often up to 50 individual nuclei were crowded together in a single cell. In others, the nuclei consisted of lobated or lumped masses of chromatin, often of enormous size. Nucleoli, quite variable in their occurrence, sometimes became a conspicuous feature. Many of the giant lipoblasts are doubtless among the largest cells produced in human neoplasms. Cells with a diameter of 300 μ or more were measured in one of our

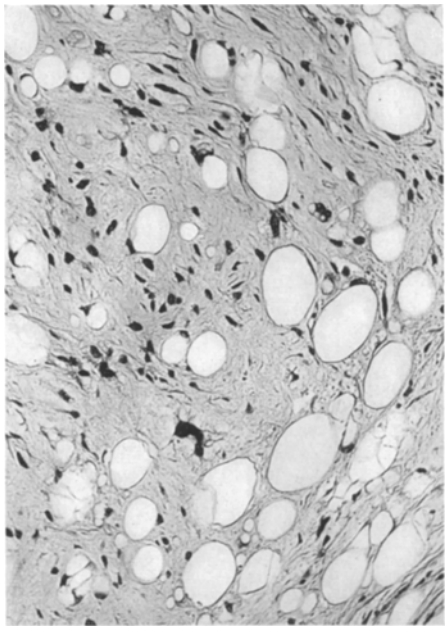

Fig. 10. Well-differentiated sclerosing liposarcoma. Admixture of adult fat cells, areas of fibrosis, and small lipoblasts. Hematoxylin and eosin. Mag. 130 ×. AFIP Neg. 61-5014

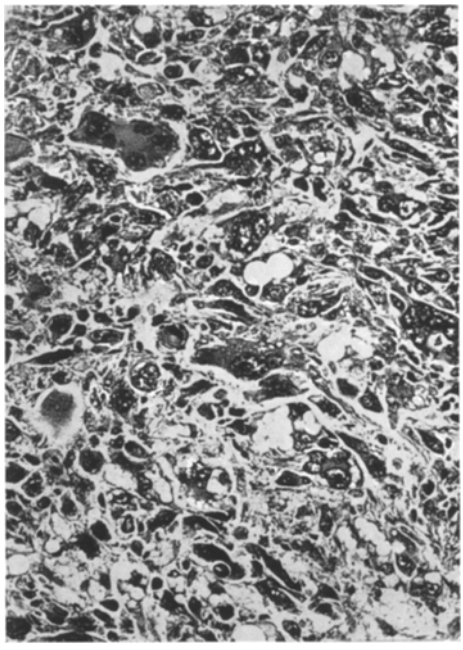

Fig. 11. Pleomorphic liposarcoma. Acidophilic giant cells and lipoblasts. Note resemblance to the so-called pleomorphic rhabdomyosarcoma. Hematoxylin and eosin. Mag. 65 ×. AFIP Neg. 61-5434

cases. Numerous smaller polygonal, round, and spindle-shaped lipoblasts were intermingled with the giant cells and formed the bulk of the neoplasm (Fig. 12).

In the second group, which constituted the majority of pleomorphic tumors, lipoblastic activity was quite limited and often confined to a few cells. While the nuclear features of the giant cells were similar to those of the fat-forming tumor, the cytoplasm differed by its prominent acidophilia. Indeed, because of acidophilia and pleomorphism, several of these tumors were originally interpreted

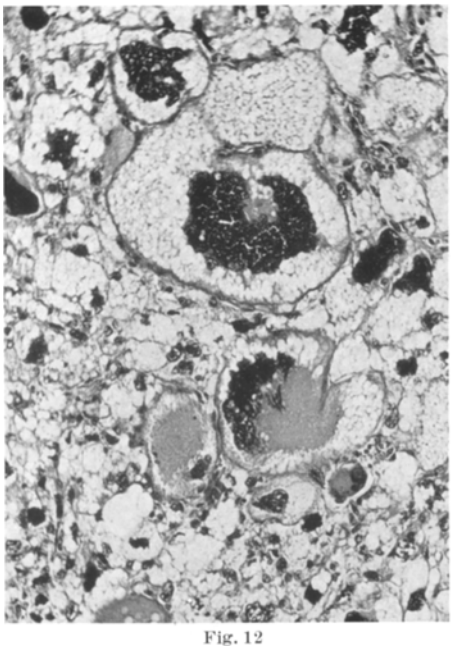

Fig. 12

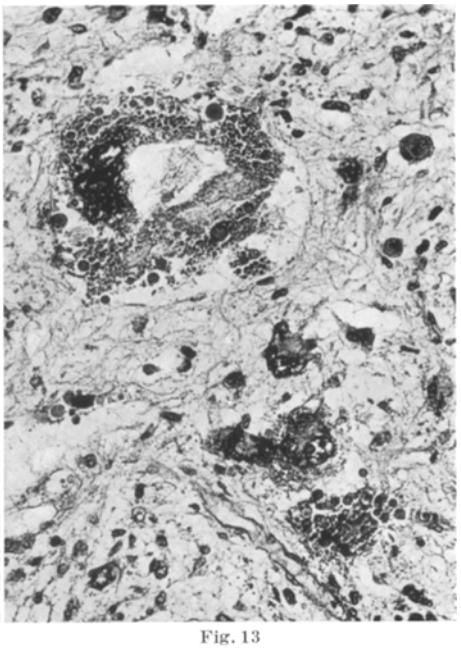

Fig. 13

Fig. 12. Pleomorphic liposarcoma. Multivacuolated giant lipoblast. Hematoxylin and eosin. Mag. 130 ×. AFIP Neg. 59-6050

Fig. 13. Pleomorphic liposarcoma. Giant lipoblast with hyaline globules in its cytoplasm. Hematoxylin and eosin. Mag. 160 ×. AFIP Neg. 60-2938

as pleomorphic rhabdomyosarcomas (Fig. 11). Giant cells having numerous hyaline globules were another feature, often but not exclusively observed in this type (Fig. 13). It is conceivable that these peculiar giant cells represent degenerated lipoblasts with a defect in lipid formation. In a few instances recognition was further complicated by areas made up of large and irregular spindle cells.

Evidence of hemorrhage and necrosis was commensurate with the pleomorphism. The incidence of mitotic figures varied but was generally low.

Histochemistry

Although the abundance of mucoid substances in some liposarcomas has been considered by some as a degenerative feature (JAFFÉ), there is by now little doubt that the mucoid substance is an essential part of the tumor. The close relationship of polysaccharide and fat metabolism has been demonstrated chemically (SIPERSTEIN), and mucoid substances are apparently an essential intermediary stage in formation of fetal fat. The reversibility of the process is demonstrated by accu-

mulation of mucoid substances in starvation atrophy of adipose tissue (Fig. 3). Indeed, the identical staining reactions of fetal fat, atrophic fat, and myxoid material in liposarcomas recall VIRCHOW'S (1) statement of the reversible interrelationship of mucoid substances and fat (1863). As the name indicates, mucoid substance was most prominent in the myxoid type but, to a lesser degree, was also encountered in differentiated and pleomorphic forms. It was conspicuous in primary tumors and in metastatic growths.

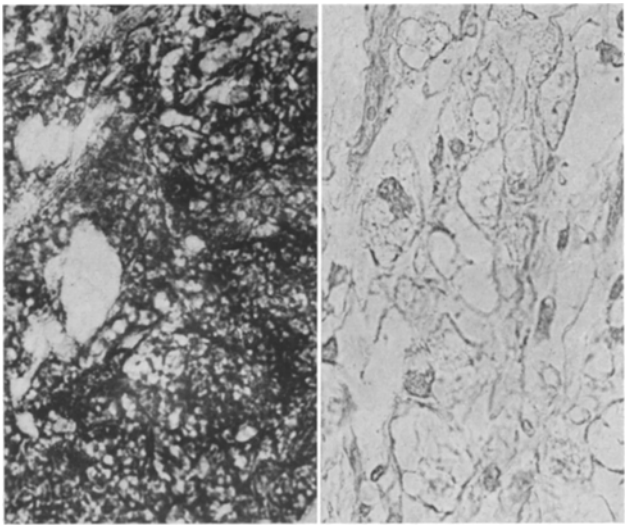

Fig. 14. Myxoid liposarcoma. Colloidal iron stain for acid mucopolysaccharides: (left) without bovine testicular hyaluronidase; (right) with pretreatment with bovine testicular hyaluronidase. Mag. 305 ×. AFIP Neg. 61-4438

Although present mainly in the extracellular matrix, intracellular mucoid material could be observed occasionally. In some cells, droplets of fat were seen within the mucoid substances.

Histochemically, the mucoid material consisted mainly of acid mucopolysaccharides, as demonstrated by the colloidal iron method and alcian blue stain. The material was removed invariably in its entirety by 2-hour predigestion at 37° C with testicular hyaluronidase (Fig. 14). It became metachromatic with toluidine blue and cresyl violet, and it was weakly carminophilic with Mayer's mucicarmine stain. The metachromasia and carminophilia were abolished by prior depolymerization with hyaluronidase. For further details, reference is made to a prior paper on this subject (WINSLOW and ENZINGER).

In frozen sections, and less distinctly in paraffin sections, diastase-digested PAS-positive material, presumably glycogen, was present in many tumor cells. The finding is of interest in view of the reported demonstration of glycogen in fat cells in animals fed after prolonged starvation.

Fat stains are often given undue significance in identification of liposarcomas. This probably stems from the fact that fat stains are rarely performed in tumors in which lipomatous origin is not suspected. Small amounts of fat, which may be deceptive for diagnosis, are seen in a large number of mesenchymal tumors, and particularly in areas of degeneration.

On the other hand, it must be emphasized that not all liposarcomas contain demonstrable fat; this lack is noticeable most frequently in round cell and pleomorphic liposarcomas.

With silver staining, a fine reticulin meshwork is frequently present. Occasionally there is a condensation of reticulin fibers about capillaries. As already pointed out, formation of thick collagen bundles is rare and is a feature that aids occasionally in differentiation from myxoid neurofibromas.

Even in the heavily fibrosed tumors, fibers remain rather delicate and rarely attach themselves to larger bundles. This dense meshwork of delicate and rather irregularly arranged fibers is an additional characteristic feature by which the nature of the tumor can sometimes be identified.

Multiple Lipomatous Tumors

The presence of multiple lipomatous tumors has been compared and related to neurofibromatosis. In both entities there are multiple subcutaneous lesions, and both are on occasion symmetrically arranged and show a hereditary tendency. The concurrence of benign and malignant tumors is not particularly rare in neurofibromatosis. Concurrence of liposarcomas and lipomas, though less frequent, has also been reported (STARKLOFF et al.).

Of our 103 liposarcomas, 5 were associated with 1 or more lipomas at other sites. Comparable sections available in three of the cases showed a distinct lipoma pattern wholly different from that of the associated liposarcoma. In two cases the onset of the lipomas preceded by several years that of the liposarcomas. In the remaining three no data as to duration were given. Our five examples, as well as those of the literature, suggest the possibility of two different and fully independent tumors arising in a patient with a general disposition toward lipomatous growth.

Origin of malignant tumors from benign lesions is not infrequently reported in neurofibromatosis. In contrast, acceptable cases in which a liposarcoma arose in a preformed lipoma seem to be exceedingly rare. No such case could be demonstrated in our material, and there is also some doubt about the validity of some of the reported instances in which malignant transformation of a lipoma is claimed. It seems likely that a good number of these cases were liposarcomas from their inception. For proper evaluation it is well to keep in mind the wide variation in structure of some liposarcomas and the fact that well-differentiated areas in an otherwise less differentiated tumor do not necessarily prove its origin in a lipoma. Conversely, myxoid degeneration in a lipoma, with sudden increase in size caused by hydration, may be mistaken for a myxoid liposarcoma arising from a lipoma. The rarity of liposarcomas in the subcutis is an additional factor to be considered. Nevertheless, in a few of the reported cases, origin from a lipoma is suggested by sudden growth in a well-encapsulated and superficially located lipoma of long standing (MARIOTTI; SAMPSON et al.; STERNBERG; WRIGHT). The case of SAMPSON et al., in which a lipoma of the scapula changed its pace of growth after having been stationary for 8 years, is such an example.

The fact that at times several apparently autochthonous liposarcomas occur at different sites has been much debated in the literature. Patients with multicentric liposarcomas have been described by ACKERMAN, GOORMAGHTIGH et al.,

SIEGMUND, HOTZ, and TEDESCHI. SIEGMUND considered these tumors analogous to lymphomas and published his case as "Lipoblastische Sarkomatose." TEDESCHI'S report was entitled "systemic multicentric lipoblastosis." Although several similar cases are represented in our material, it was difficult to draw a precise line between multicentric tumors and metastatic growths, particularly since "multicentric liposarcomas" and obvious metastatic growths are frequently found in the same patient. The problem this presents may be best illustrated by one of our cases:

AFIP Acc. 502207: A 35-year-old white male was first seen in March of 1947 with a large myxoid type of liposarcoma of the upper *right* thigh. It was excised but recurred six times within the next 2 years. In June of 1949 a right hemipelvectomy was performed. One year later the tumor recurred at the hemipelvectomy site, and a large tumor mass could be palpated in the lower abdomen. In November 1950 tumors of similar structure appeared over the right anterior chest wall and posterior aspect of the *left* lower thigh. Chest x-rays showed lesions in both lung fields and destruction of the ninth rib. The patient failed to respond to x-ray therapy and died in February 1951.

At autopsy large, yellowish-white tumor masses exceeding 20 cm in diameter were found in the *right* inguinal region and within the pelvis and the retroperitoneal space. Tumors of similar appearance were present at the anterior chest wall and *left* lower thigh. Numerous large and somewhat pedunculated tumors covered the serosal surfaces of lung and liver. The lung and liver also contained a number of rather inconspicuous tumor nodules. In addition, there was invasion of the pancreas, lumbar vertebrae, and mediastinal and periaortic lymph nodes. Histologic examination of these lesions revealed a uniform histologic pattern, predominantly of the round cell type.

In summary, then, a liposarcoma of the right upper thigh was followed by the appearance of similar tumors in the left thigh, retroperitoneum, chest wall, liver, and lungs.

In our series, secondary tumors at other sites were encountered in 27 patients. In seven patients pleomorphic liposarcomas had metastasized to lung (seven), bone marrow (three), mediastinum (two), and pleura (one), several showing more than one metastatic site. In the remaining 20 patients, in whom the tumors were exclusively of the myxoid and round cell types, the pattern of spread was quite different. In these tumors the secondary lesions occurred less rapidly and at locations that raised the question of multiple tumors or metastasis. Yet, at later stages of the disease these lesions were often combined with outright metastatic growths.

In 11 patients a myxoid or round cell liposarcoma of the lower extremity was followed by a tumor of similar structure in the retroperitoneum, mesentery, or omentum. The opposite — a tumor of the retroperitoneum followed by a similar lesion in an extremity — was not encountered, however. A distinct propensity for the serosal or subserosal tissues was demonstrated by additional growths in the pleura (seven), epicardium (four), and diaphragm (three). It is of great interest that in these cases further tumors were noted in the neck and shoulder region (four), axilla (three), and opposite thigh (one). Therefore, these lesions occurred precisely at those locations in which normally liposarcomas show the highest incidence. It seems significant that these lesions never appeared simultaneously. In every instance there was a definite time interval between primary and secondary lesions: In our series the average interval between onset of the liposarcoma in the lower extremity and that in the retroperitoneum was 4.7 years,

between lower extremity and pleura 6.8 years. Furthermore, most of these tumors showed at autopsy metastatic growths to lung (nine), liver (three), and bone marrow (three). Some of the cases that have been entered in the literature as multiple liposarcomas likewise show late lesions in lung, liver, and bone marrow. In GOORMAGHTIGH'S patient 214 different sites were encountered at autopsy.

On the basis of our findings, neither proof nor refutation can be found of the concept that a "pluri-centric diffuse anlage" or "an alteration of lipid metabolism with incidental stimulation of undifferentiated mesenchymal cells" (TEDESCHI) is responsible for the occurrence of "multiple primary liposarcomas." It is conceivable, however, that in the myxoid and round cell type an intermediate stage of protracted tumor spread exists that precedes outright metastasis. The mode of dissemination, however, is not clear. Invasion of lymphatics is rare in liposarcomas. Of 24 patients of our series in whom regional lymph nodes were examined, metastatic growths in lymph nodes were found only in one instance. Direct extension along connective tissue spaces and serosal membranes as well as hematogenic spread appears more likely. Secondary lesions were seen only in the myxoid, round cell, and pleomorphic types. Despite the tendency to multiple local recurrences and infiltrative growth the well-differentiated type was always confined to the general region of its primary site.

Role of trauma. As in most soft tissue tumors, evaluation of the significance of trauma in the causation of liposarcomas is most difficult, particularly in view of the frequency with which minor traumas are sustained. Direct correlation can be ruled out in most instances by a critical review of the type of trauma and the time interval between trauma and the first occurrence of the lesion. EWING (2) considered a possible relationship and stated that "he was impressed by the number of cases with a definite history of severe trauma and hemorrhage." Any connection between trauma and liposarcomas, however, is denied by most authors [PACK and PIERSON; STOUT (1); ENTERLINE et al.]. In our material, preceding trauma was mentioned in 11 cases. Trauma preceded liposarcomas of the lower extremity in 10 instances and a retroperitoneal tumor only once. This amounts to an overall incidence of trauma of 11% (17% for the lower extremities and 2% for the retroperitoneum). It is of interest that 10 of the 11 cases were of the myxoid type. In most of our patients, trauma was not severe, and therefore its significance is doubtful; yet, development of a liposarcoma following severe trauma was sufficiently frequent to merit consideration.

One of our patients, a 33-year-old white male (AFIP Acc. 742127), hit his leg on a frame in a mill. An ensuing hematoma was evacuated by the local surgeon. Sixteen months later a small knot appeared at the site of injury. Biopsy revealed a myxoid liposarcoma. — Another patient, a 61-year-old man (AFIP Acc. 842836), stuck a butcher knife deep in the right lower posterior thigh. After severe hemorrhage a large grapefruit-sized hematoma developed. The swelling disappeared, but 1 year later at the same site a firm mass was noted, which on biopsy proved to be a myxoid liposarcoma. — A third patient, a 33-year-old white male (AFIP Acc. 807847), was injured by a falling boiler stack, causing a large hematoma. Twelve months later a small, slowly growing nodule occurred at the site of injury. Biopsy diagnosis: myxoid liposarcoma. — Finally, a 50-year-old white patient (AFIP Acc. 538074), stepped through a subflooring of a construction project and injured his lower leg. Although the initial reddish swelling and tenderness disappeared, a pleomorphic liposarcoma developed in the area of injury 8 months later.

Several similar cases are reported in the literature. For instance, one of ENTERLINE'S patients was struck by a steel beam in the thigh 6 months before a liposarcoma developed at that site. Another case in which a liposarcoma followed a large hematoma is reported by TANAKA and CHEN. PACK and PIERSON report a myxoid liposarcoma that appeared 6 months after the patient suffered lacerations and a hematoma in a riding accident. Liposarcomas following irradiation were not present in our series, but such cases have been described [ENTERLINE et al.; STOUT (2); ROSENBAUM].

In our material, the time interval between injury and trauma was given in nine cases and ranged between 6 months and 16 months. These data are compatible with those of the literature.

Despite these cases, there is still no proof of a causal relationship between trauma and the development of a liposarcoma. The possibility that trauma serves occasionally as a trigger mechanism deserves consideration, however.

Clinical Course and Therapy

Follow-up studies were available in 91 patients. Of the 91, 43 were living and 48 were dead at the time of last information. In 25 of the living patients the follow-up period was 5 or more years; in 15, 2 to 5 years; and in only 3 patients, less than 2 years. Recurrence of the liposarcoma was reported in 19 of the living patients. Although in the majority of these the tumor had recurred more than once, recurrence was often delayed by several years. The remaining 24 patients were well and free of symptoms. The 5-year survival rates according to anatomic site and histologic type are given in Figs. 15 and 16. Survival was considerably better in patients with tumors of the lower extremity than in patients with tumors of the retroperitoneum. For instance, the 5-year survival rate of myxoid liposarcomas in the retroperitoneum was 39%, whereas the survival rate of the same tumor in the lower extremity was 71%. As expected, the survival rates of patients with well-differentiated and myxoid tumors were much higher than those of patients with the round cell and pleomorphic liposarcomas. For the myxoid and well-differentiated types the median survival time was about 9 years,

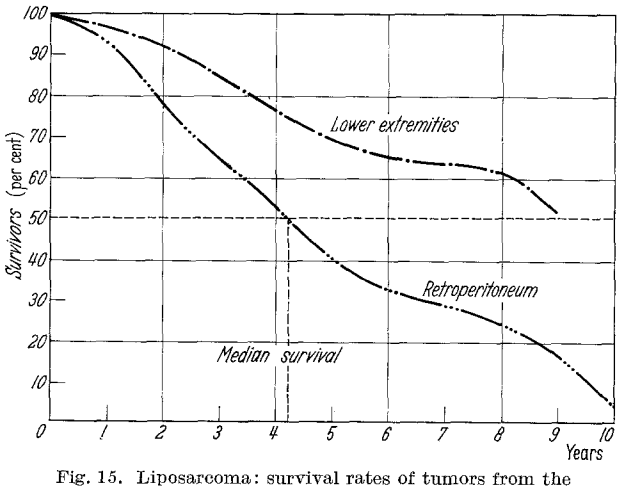

Fig. 15. Liposarcoma: survival rates of tumors from the retroperitoneum and lower extremity

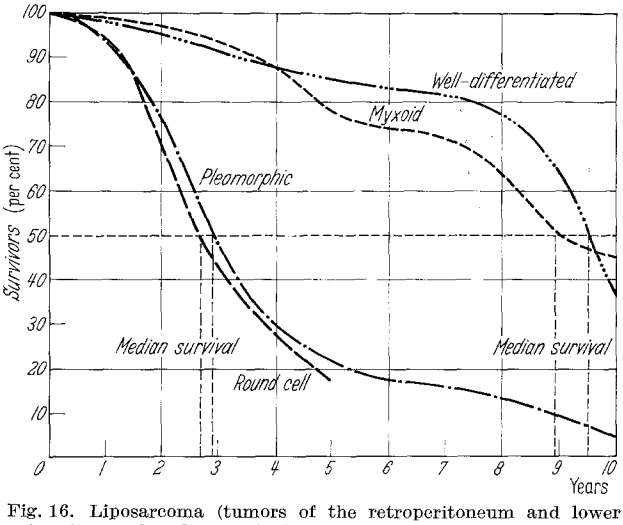

Fig. 16. Liposarcoma (tumors of the retroperitoneum and lower extremity combined): survival rates according to histologic types

while for the round cell and pleomorphic types it was less than 3 years (Fig. 16). Percentage figures on clinical behavior by histologic type are given in Table 5.

With one exception, all our patients were treated by surgery only, or by surgery and postoperative roentgenotherapy. Of the 59 patients with tumors of the lower extremity, 12 patients were treated by amputation only, and 5 by amputation and postoperative irradiation. It is noteworthy that in nine patients the extremity was amputated for a myxoid liposarcoma. In 42 patients the tumor was excised, but in most cases no information could be obtained regarding exact extent of the excision. Five of these patients received postoperative irradiation. Similarly, 41 of the 42 retroperitoneal tumors were treated by excision. One patient received roentgenotherapy only, and nine were irradiated postoperatively.

Table 5. *Liposarcomas: Clinical Behavior by Histologic Type*

Tumor type	Patients with local recurrence %	Patients surviving 5 years %
Myxoid	53	77
Round cell	85	18
Well-differentiated	53	85
Pleomorphic . . .	73	21

The effect of therapy differed somewhat at the two tumor sites. The survival rates of the retroperitoneal sarcomas indicated a slightly better prognosis for tumors treated by surgery and irradiation (5-year survival: surgery alone, 53%; surgery and irradiation, 63%). Yet, the data on the lower extremity fail to bring out any significant beneficial effect of postoperative irradiation (5-year survival: surgery alone, 87%; surgery and irradiation, 75%). These figures are somewhat in contrast with several statements in the literature that claim good response to irradiation in myxoid liposarcomas [EWING (1); FRIEDMAN and EGAN; PACK and PIERSON; and ENTERLINE et al.]. It is conceivable, however, that a difference in the indication for postoperative irradiation may account for this fact.

The better prognosis of the liposarcomas of the extremity can be explained at least in part by two factors: earlier detection because of the more superficial location, and better accessibility for total extirpation.

Acknowledgments. Appreciation is expressed to Mrs. MARDELLE REYNOLDS and Mrs. MARY LEVITIN for their statistical suggestions in preparing this manuscript.

Summary

A clinicopathologic analysis of 103 liposarcomas from the lower extremity and the retroperitoneum was presented. The tumors were divided according to their histologic pattern into four groups: liposarcomas of the myxoid cell, round cell, well-differentiated, and pleomorphic types. The various histologic groups differed considerably in location, age distribution, and clinical behavior. The myxoid and round cell types were most common in the lower extremity, while the majority of well-differentiated and pleomorphic liposarcomas originated in the retroperitoneum. The median age of patients with myxoid and round cell tumors was also about 11 years less than that of patients with well-differentiated and pleomorphic liposarcomas.

Follow-up information obtained in 91 of the patients revealed that all liposarcomas irrespective of type had recurred in more than 50% of the patients. Yet, the 5-year survival rates of the myxoid and well-differentiated types were almost four times those of the round cell and pleomorphic types, and the over-all

survival rates were considerably better in the liposarcomas of the lower extremity than in those of the retroperitoneum.

Zusammenfassung

Der Arbeit liegen 103 Liposarkome der unteren Gliedmaßen und des Retroperitonealraums zugrunde. Nach dem histologischen Struktur- und Zellbild werden 4 Typen unterschieden: der myxoide, der Rundzell-, der hochdifferenzierte und der pleomorphe Typus. Die histologischen Varianten zeigen in bezug auf Lokalisation, Alter des Patienten und klinischem Verhalten beträchtliche Unterschiede. Der myxoide und Rundzelltypus kommt besonders an den unteren Gliedmaßen vor, während die Mehrzahl der hochdifferenzierten und pleomorphen Sarkome vom Retroperitonealraum ihren Ausgang nehmen. Das mittlere Lebensalter der Patienten mit myxoiden und Rundzell-Liposarkomen liegt 11 Jahre tiefer als dasjenige der Patienten mit hochdifferenzierten und pleomorphen Liposarkomen. Die Katamnesen von 91 Patienten zeigen, daß Liposarkome, unabhängig vom histologischen Typus, in 50% der Fälle rezidivieren. Die 5-Jahresüberlebensdauer ist bei dem myxoiden und hochdifferenzierten Typus viermal höher als bei dem Rundzell- und pleomorphen Typus. Gesamthaft liegen die Überlebenszeiten der Träger der Liposarkome der unteren Gliedmaßen erheblich über denjenigen des Retroperitonealraumes.

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