TUMORS OF BLOOD VESSELS
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Tumors of the blood vessels are perhaps as common as any form of neoplasm occurring in the human body. The greatest number of these lesions are benign angiomas of the body surfaces, small elevated red areas which remain without symptoms throughout life and are not subjected to treatment. Larger tumors of this type which undergo active growth after birth or which are situated about the face or oral cavity, where they constitute cosmetic defects, are more often the object of surgical removal. The majority of the vascular tumors clinically or pathologically studied fall into this latter group. Benign angiomas of similar pathologic nature occur in all of the internal viscera but are most common in the liver, where they are disclosed usually at autopsy. Angiomas of the bone, muscle, and the central nervous system are of less common occurrence, but, because of the symptoms produced, a higher percentage are available for study.

Malignant lesions of the blood vessels are far more rare than was formerly supposed. An occasional angioma may metastasize following trauma or after repeated recurrences, but less than 1 per cent of benign angiomas subjected to treatment fall into this group. Primarily malignant tumors of the vascular system—angiosarcomas—are equally rare. The pathological criteria for these growths have never been adequately established, and there is no general agreement as to this particular form of tumor. The multiple hemorrhagic sarcoma of the skin described by Kaposi may perhaps belong to this group.

A small but interesting group of epithelial and neurologic tumors is characterized by an overgrowth of vascular elements. The so-called angiomas of the sweat ducts or hemorrhagic basal-cell cancer, and tumors of the glomus described by Masson as angiomyoneuromas are of this type and may properly be included in a discussion of tumors of blood vessels.

Benign Hemangiomas

Embryologic Relations and Distribution: The earliest network of endothelium and blood spaces in the human embryo develops in the third week from the mesoderm overlying the yolk sac at the junction of

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the foregut and hindgut. Here the vascular tree takes root, the major structures of heart, aorta, and hepatic vessels being the first to appear. From this central mesenchymal network, the vascular tree grows by extension, the peripheral channels eventually forming the capillary network in the subcutaneous and submucous tissues.

In incidence and distribution hemangiomas follow the central and peripheral growth zones of the vascular system. In a series of 570 tumors of this type listed in the Johns Hopkins Hospital, 109 occurred in the liver, 16 on the valves of the heart, and 10 in the retroperitoneal or peritoneal structures of the kidney, spleen, intestine, or mesentery. Of the remaining group of 435 lesions, the majority were located in the subcutaneous and submucous regions, suggesting a relationship to peripheral growth. Of these, slightly over 200 occurred superficially in the region of the face, scalp, and oral cavity, and 164 on the surface of the body and of the upper and lower extremities (Table I). Of the tumors about the head and oral cavity, those on the lips, eyelids, and cheeks predominated. Forty out of 60 of the lesions on the upper extremity involved the fingers or hand, and 15 out of 50 on the lower extremities were about the ankle, foot, or toes. In about 5 per cent of all cases multiple nodules were present.

### TABLE I: Distribution of 570 Hemangiomas

<table>
<thead>
<tr>
<th>Central Angiomas</th>
<th>Peripheral Angiomas</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>Scalp and neck</td>
<td>135</td>
</tr>
<tr>
<td>Heart valves</td>
<td>Face and forehead (eyelids, 25)</td>
<td>109</td>
</tr>
<tr>
<td>Internal viscera including mesentery, kidney, gastro-intestinal tract</td>
<td>Oral cavity (lip, 35)</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Skin of body</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Arm (fingers, hand and forearm, 40)</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Leg (foot, ankle, toe, 15)</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Vulva and scrotum</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Angiomas in Special Locations</td>
<td>370</td>
</tr>
<tr>
<td></td>
<td>Bone</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Intermuscular</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Central nervous system (brain and spinal cord)</td>
<td>54</td>
</tr>
</tbody>
</table>

This study of the distribution of angiomatous lesions is based only on surgical and autopsy records and does not include the very common angiomas on the surface of the body and elsewhere which escape clinical and pathologic study. It may, nevertheless, be concluded that the substance of the liver in the region where the blood vessels first make their appearance in the embryo, and the surfaces of the body where the peripheral endothelial channels are later elaborated, are the predominant sites for the occurrence of these growths.

Ribbert's theory that these tumors develop from embryonic rudiments is also borne out by the age incidence. If the central angiomas found most commonly in the liver incident to autopsy are omitted, the congenital origin of these lesions becomes more apparent. Of slightly more than 300 patients from whom peripheral angiomas were removed
at operation, 97 were under ten years of age and of these 78 were five years or younger. After the first decade the incidence of these tumors gradually decreases (Table II).

**FIG. 1. SUPERFICIAL CAVERNOUS HEMANGIOMA. PATH. NO. 32670**
The dilated cavities containing red blood cells are associated with lymphangiomatous spaces.

**TABLE II: Age Incidence of Peripheral Angiomas**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td>78 cases</td>
</tr>
<tr>
<td>6-10 years</td>
<td>19 cases</td>
</tr>
<tr>
<td>11-20 years</td>
<td>61 cases</td>
</tr>
<tr>
<td>21-30 years</td>
<td>33 cases</td>
</tr>
<tr>
<td>31-40 years</td>
<td>33 cases</td>
</tr>
<tr>
<td>41-50 years</td>
<td>32 cases</td>
</tr>
<tr>
<td>Over 50 years</td>
<td>42 cases</td>
</tr>
<tr>
<td>Total</td>
<td>318 cases</td>
</tr>
</tbody>
</table>

**Clinical and Pathologic Types:** Hemangiomas have been variously subdivided on the basis of their clinical or pathologic appearance. The two generally recognized forms are the cavernous and the capillary. The cavernous angioma (Fig. 1) is composed of dilated blood spaces with thin walls and is commonly seen as a vascular nevus or birth mark on the face, or as a bluish elevated mass on the mucous surfaces of the oral cavity. Angiomas of the liver are practically all of the cavernous type. Both arterial capillaries and venules may form cavernous angiomas, although some authors have sought to define the cavernous angiomas as venous in origin.

Capillary angiomas occur most commonly as red, spongy, elevated lesions projecting from the subcutaneous tissues of the face, scalp, or extremities. As the name implies, the tumor is composed histologically of a fine network of capillaries (Fig. 2). When active proliferation is
occurring in these growths, masses of endothelial cells are seen about the vascular channels, creating a cellular subvariety of tumor here referred to as angioblastic hemangioma (Fig. 3). The more slowly growing capillary angiomas contain vessels of adult character and the endothelial spaces are surrounded by smooth muscle and fibrous tissue. Such a network of vessels, approaching the adult form, may be referred to as the adult or organoid subvariety of capillary angioma (Fig. 4). Such pathological classifications are necessarily ill-defined and merge
one into the other. Many capillary angiomas contain cavernous areas, and vice versa. Typical capillary angiomas are rare, areas of the angioblastic or organoid type being commonly seen in these growths.

*Hepatic and Superficial Cavernous Hemangiomas:* Angiomas of the liver comprise one-sixth of the benign vascular tumors in this series. With few exceptions the lesions are accidental findings at autopsy in adults. The majority in this series were solitary growths, 0.5 to 5 cm. in diameter, near the surface or capsule of the liver. Grossly they were soft, purplish, circumscribed areas (Fig. 5). Under the microscope dilated endothelial-lined spaces with papillary infoldings and numerous red blood cells were commonly seen. More rarely the vascular spaces were separated by hepatic tissue and associated with fibrous bands or an increased amount of stroma. In only two instances were adults

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**Fig. 4. Hemangioma Composed of Arterioles and Dilated Capillaries.** Path. No. 45105

This variety of arteriolar angioma has been called the organoid type. Note the muscular walls surrounding the vessels.

**Fig. 5. Unusual Angioma of the Liver.** Path. No. 46776

The cavernous spaces are widely separated by cords of hepatic cells and fibrous tissue.
subjected to operation for a mass discovered in the upper abdomen which proved histologically to be angiomatous.

Superficial cavernous angiomas in this series approximate in frequency those of the liver. They are slightly more frequent on the surface of the lips and tongue than in subeutaneous regions (Figs. 6A and B). If the spaces are large and filled with circulating blood, pulsation may be felt. With coagulation and calcification a hard nodular tumor may be formed. The lesions tend to take on a darker appearance than the capillary angiomas, and in some instances they are undoubtedly of venous origin. As seen under the microscope, venous cavernous angiomas are prone to be associated with dilated lymphatics and a fatty stroma. The arterial cavernous angiomas consist of thin-walled endothelial spaces filled with red blood cells associated with areas of hemorrhage and zones of angiomatous tissue of capillary type (Fig. 7).

Capillary Hemangiomas: Two-thirds of all the superficial angiomas in the present series were of the capillary type. This form of lesion presents a variety of clinical manifestations which have been reviewed in detail by Sonntag, who gives a complete bibliography. The simplest of these is the so-called telangiectasis or port-wine stain, sometimes called hemangioma simplex. This is a discolored, non-elevated area composed of a network of small capillaries without marked microscopic evidence of cellular proliferation. Capillary angiomas with evidence of more active growth produce soft elevated nodules upon the skin or papillomas on the mucous surfaces (so-called vascular nevi). These are spongy, red growths which blanche on pressure. As seen under the microscope the endothelial channels are often compressed by the endothelial elements which tend to form solid or diffuse areas. Such growths are often progressive or are stimulated to activity by infection and trauma. Rapid increase in size, ulceration, infection, and hemorrhage may complicate these lesions. Tumors of this group, when showing histologic evidence of rapid proliferation, are sometimes termed hemangioma hypertrophicum, hemangio-endothelioma, or angioblastoma (Figs. 8A–D). They are sometimes difficult to distinguish microscopically from sarcoma.
In cases of progressive angioma, enlargement of an entire limb may occur. In two cases in this series multiple progressive and recurrent capillary hemangiomas appearing in infancy were associated with bony enlargement on the affected side and corresponding hypertrophy of the soft tissues. Such hemihypertrophy may persist or progress even while the angiomatic lesions are under control by radiation therapy. Similar but more pronounced cases of angio-elephantiasis have been reported with arteriovenous fistulae.

*Congenital Arteriovenous Fistulae:* Congenital angiomas, usually about the face or scalp but also on the extremities, may be the starting point for aneurysmal tumors (Fig. 9). These are known under a wide variety of names, as cirsoioked aneurysm, racemose aneurysm, and congenital arteriovenous fistulae. In the older literature some of these have been described as angio-elephantiasis. Lewis has collected a series of these vascular tumors and reviewed the literature.

In reviewing 30 cases, 24 from the literature and 6 of his own, Lewis defines these cirsoiiked aneurysms or congenital arteriovenous fistulae as regions of vascular hypertrophy in which the arteries communicate with each other and in which the arterial channels communicate with
the veins without an intervening capillary bed. The congenital basis of the lesion is thought to be an angiomatosus anomaly in which the embryonic vascular network persists without the formation of more definitive channels. The rapidity with which the disease becomes mani-

![Image](image_url)

**Fig. 8C. Low-power Photomicrograph Showing Capillary Structure of Tumor in Patient Shown in Figs. 8A and B.**

![Image](image_url)

**Fig. 8D. High-power Photomicrograph Showing Marked Endothelial Proliferation of Tumors Shown in Figs. 8A–C.**

fest after birth and the severity of the symptoms are dependent upon the size, number, and directness of the arteriovenous communications. Trauma often plays a rôle in exacerbating the condition. A local collapsible swelling is produced, in which the tortuosity and pulsations of the underlying vessels are usually visible. A thrill and bruit are
present and may be felt and heard in both systole and diastole. The patients have a low diastolic blood pressure, a high pulse pressure, tachycardia, and sometimes cardiac enlargement. The bradycardiac reaction, in the form of slowing of the pulse by 20 to 40 beats with compression of the artery or vein leading into the involved region, can usually be demonstrated. At operation the size of the veins, their bright red color, and their pulsation are characteristic. In some of the cases reported by Lewis, ligation of the major communicating vessels resulted in cure of the condition, while in others amputation of the extremity was necessary. Multiplicity of the communications between arteries and veins makes this type of vascular lesion far more difficult to treat than the simple traumatic arteriovenous aneurysm.

Therapy of Hemangiomas: In the cavernous and capillary hemangiomas producing symptoms, cosmetic defects, or undergoing progressive growth, early treatment is indicated. Surgical excision is preferable for the smaller growths where a scar is not deforming. The simple angioma or port-wine stain may be successfully treated by electric coagulation. Capillary and cavernous growths may be healed by external radiation, and the larger growths of this type with aneurysmal tendencies may be treated by a combination of ligation of the larger vessels and radon implantation. Chemical coagulation, freezing with carbon dioxide snow, and injections of boiling water are among the methods that have been used in the past.

Multiplicity of lesions, sometimes within the same region, must be borne in mind in treatment. The non-encapsulated character of these growths is also a factor in recurrence. Kramer reports 23 multiple lesions in 147 cases and 7.5 per cent of recurrences. In our own series multiple lesions of significant size and recurrences were slightly under these figures.
Spontaneous healing is not uncommon in the smaller angiomas, particularly those of the telangiectatic type occurring in children. Healing without treatment may also occur in the larger growths following thrombosis, or rarely following upon ulceration, infection, and fibrosis. Usually these growths, when left untreated, enlarge, erode, or compress vital structures, and may produce fatal hemorrhage.

**Hemangiomas of Bone:** Angiomas of both the capillary and cavernous type may be found in the skull, spine, and long bones. The cavernous type is the more common. Both varieties have a tendency to destroy bone and to produce in the roentgenogram multilocular areas of rarefaction. Bucy and Capp have reported the angiomas of bone recorded in the bone registry of the American College of Surgeons. In the present series there were 5 such lesions in the skull, 1 in the spine, and 6 in the long bones. In the bones of the extremities the lesions resemble roentgenographically the benign bone cyst. Adults, however, are more commonly involved (3 out of 6 in this series). In 4 cases there was a characteristic subcortical localization with a thin expanded shell of cortical bone (Fig. 10). In the other two cases, both in children, aged seven and eleven years, the angioma was central in location and produced a more rapidly progressive zone of destruction than is seen in cystic disease. In one of these cases explored as a bone cyst the cavity

**Fig. 10. Angioma of Bone Occurring in the Femur of a Girl of Seventeen.**

Path. No. 45686

The roentgenogram emphasizes the characteristic subcortical location of the tumor and the thin expanded shell of cortical bone. This lesion was successfully treated by x-ray therapy.
contained hemorrhagic rather than straw-colored fluid, and the curette disclosed typical angiomatous tissue. In the other instance, explored elsewhere, a very cellular hemorrhagic tissue rather than a cystic cavity

**Fig. 11. Angioma of the Humerus in a Child Aged Eleven. Path. No. 54292**

In the roentgenogram the lesion resembled a benign bone cyst, but progressed rapidly following pathologic fracture.

**Fig. 12. Erosion of the Parietal Bone by a Venous Aneurysm of the Dura**


was found at operation (Fig. 11). The tissue was microscopically interpreted as sarcoma and the arm amputated. The other cases were cured by local excision in four instances and deep x-ray therapy in one.
Angiomas of the skull may produce a cyst-like expansion of one or both tables and show little or no tendency to increase in size over a period of years. There were 2 such cases in this series. In other instances the lesion may be continuous with the scalp above or with the dura and brain beneath. In one instance a congenital angioma was excised from the scalp and skull of a girl aged seventeen months. The inner table of bone was intact. In two cases, which have been previously reported by Dandy, the skull, dura, and brain were invaded. One of these lesions was described by Dandy as a venous aneurysm arising in the longitudinal sinus and the other as a cavernous angioma in the posterior cranial fossa and extracranial occipital region (Fig. 12).

Hemangiomas of the spine are being recorded with increasing frequency. Bucy and Capp have discussed the radiological appearance of these lesions. Cases of this character have been successfully treated by irradiation, electrocoagulation, and excision. Junghanns has reported the successful excision of an angioma of the third thoracic vertebra compressing the spinal cord, and Roith reports a similar case successfully controlled by electrocoagulation. Fig. 13 illustrates the roentgenographic appearance of hemangioma involving the fourth, fifth, and sixth cervical vertebrae with compression of the spinal cord. The patient had attacks of coma and epilepsy and the condition was diagnosed elsewhere as hysteria.

Hemangiomas of Muscle: Angiomas of muscle have been reviewed by Jenkins and Delaney, who were able to collect 256 cases from the literature. Ten such lesions are recorded in this series. These lesions are usually of the cavernous type and tend to progress under the in-
fluence of trauma. Swelling, pain, and tenderness, with impairment of function, result. Aspiration of blood from the tumor or the detection of phleboliths in the roentgenogram aid in making the diagnosis.

In the present group of cases the lesions occurred in young adults and were approximately equally divided in distribution between the upper and lower extremities. Judging from the histories, these growths were congenital in origin and progressed slowly over a number of years. The characteristic clinical signs were change in the size of the swelling with change in the position of the limb, softness and compressibility of the tumor, and exacerbation of symptoms following trauma. In all but two instances the growths were successfully treated by excision. In the remaining cases repeated recurrences and deformity of the limb necessitated amputation.

Vascular Lesions of the Nervous System: Dandy has reported a study of the vascular lesions treated by himself at the Johns Hopkins Hospital. Of 600 verified tumors of the brain, 5 per cent were of this type. Cushing has reported a similar series. Dandy's cases include venous abnormalities, cysts with angioma (capillary angioma), and cavernous hemangiomas.

The capillary angiomas are usually small, spongy, red tumors embedded in the wall of large cysts. Both Lindau and Dandy find such cysts in the brain to be more frequent than gliomatous cysts. The cysts are accompanied by signs of intracranial pressure. Those in the cerebral hemispheres produce localizing signs such as speech, sensory, motor or visual defects, while those in the cerebellum are accompanied by ataxia, nystagmus, and often hydrocephalus. The period of symptoms is brief, and the time of onset usually between the ages of twenty-five and fifty years. In these cases it is the cyst formation (possibly the result of hemorrhage) and not the angioma which causes the symptoms.

Cavernous angiomas are most frequent in the cerebral hemispheres. The symptoms usually have their onset in childhood and continue over a period of from five to thirty years. The most common manifestation of the new growth is jacksonian epilepsy. These tumors rarely attain sufficient size to produce intracranial pressure.

One-fifth of the cysts with angioma and about one-third of cavernous angiomas are accompanied by multiple angiomas in the nervous system and elsewhere. Particularly striking is the association of angioblastoma of the retina (von Hippel's disease) and cerebellar angioma, emphasized by Lindau. This author also has pointed out the relatively frequent occurrence of pancreatic and renal cysts in conjunction with these vascular lesions, suggesting a common congenital basis for this group.

Recently Wolf and Wilens have reported multiple angiomas of the spinal cord in a man of thirty-three years in whom the right eye had been enucleated twelve years previously for detachment of the retina (angioma?). Cerebellar symptoms and evidence of syringomyelia were followed by pneumonia and death. Autopsy disclosed three
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angiomas of the cord and one in the cerebellum, and cysts of the pancreas and kidneys. Fourteen angiomas of the cord have been operated upon at the Johns Hopkins Hospital to date. The literature is reviewed by Ritter.

MIXED VASCULAR TUMORS

Many cases have been reported in which angiomatous changes are combined with neoplasms of other tissues. Fibro-angioma, angiolipoma, angiomyoma, lymphangiocavernoma and angiochondroma have been described. The so-called fibro-angiomas are often highly differentiated capillary angiomas with varying amounts of fibrosis. The combination of hemangiomatous areas with areas of lymphangioma is not uncommon in cases of cavernous angioma. Uterine myomas of invasive character are often highly vascular, and occasional myomas arise apparently from the muscular walls of blood vessels. True angiolipomas are rare (Fig. 14), but the combination of lipomatous and angiomatous tumors in the same individual is more commonly reported (Bowen, Little). Cases of multiple congenital enchondromas associated with multiple hemangiomas have also been described, and two cases recorded in the Surgical Pathological Laboratory showed many large tumors of both types.

The tumor combinations mentioned above are not truly mixed tumors, since a common tissue, the mesenchyme, furnishes the mother substance for both components of the new growth. Of special interest, however, are those combinations of hemangiomatous tissue with epithelial and neural structures.

Angiomyoneuromas (Glomic Tumors): In 1924 Masson ascribed the so-called subungual perithelioma of the older literature to a peculiar neuromyo-arterial organ found in the nail bed, which he compared to
the coccygeal glomus of Luschka. Masson related these organs to the function of maintaining local blood pressure and temperature. Similar structures are said to occur in the subcutaneous tissues of the extremities, and, since the contributions of Masson, glomic tumors have been found in the leg, forearm, and thigh. They are most frequent about the hand and forearm, where they form small circumscribed painful growths of benign encapsulated character. Hopf in 1930 was able to collect and study 19 cases. The ages of the patients varied between eighteen and eighty-two years. The characteristic symptom was increasing pain extending over many years.

Masson describes the glomus histologically as composed of the branches of an arteriole leading to the corium. These branches are

connected with the venous capillaries and skin veins by a number of veins with wide lumens. The muscular walls of the arteriole are thickened and without internal elastic laminae. They are made up of peculiar light-staining cells with large nuclei which resemble ganglion cells or altered smooth muscle cells and some have protoplasmic elongations, considered by Masson as non-medullated nerve fibers. The tumors derived from these structures show a proliferation of the fibrous elements, the ganglion-like cells, resembling mole cells, and areas of cavernous angioma.

There are ten glomic tumors recorded in this series, all of them benign encapsulated lesions in adults, with a long duration of symptoms. Two of the tumors were on the leg and thigh, 6 on the hand or fingers, and 2 on the forearm. The duration of the symptoms was from one to fifteen years. In one of the cases the finger was repeatedly lanced and the bone scraped on the impression of a felon. The accompanying illustrations show the gross and microscopic features (Figs. 15–19).

Angiomas Associated with Squamous-cell Hypertrophy and Basal-cell Proliferation: Angiomas may begin in the papillae of the dermis
or about the sweat glands. Angioma of the papillae accompanied by hypertrophy of the epidermis is known as angiokeratoma, a term proposed by Mibelli. Angiomas arising about the sweat ducts are not uncommon. Multiple congenital lesions of this type have been described (Archer). These are usually multiple reddish purple, subepidermal tumors in which cavernous angiomas surround the hypertrophied channels of the sweat ducts.

A distinctly different group of tumors showing a proliferation of basal cells arising probably from skin appendages, and surrounding cavernous angiomatous spaces, is recorded in this series. No appropriate description or terminology for this type of compound basal-vascular tumor could be found in the literature. For the group of six cases sum-

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**Fig. 16. Photomicrograph of the lesion from the Case Shown in Fig. 15, showing the encapsulated character of the growth**

marized below the term hemorrhagic basal-cell tumor is suggested. Perhaps similar tumors have been described heretofore under the old term cylindroma.

The six hemorrhagic basal-cell lesions in this group occurred in adult women, from thirty-five to fifty-six years of age. The location of the tumors was as follows: thigh, buttocks, axilla, cheek, lip, and forehead, each one. In the patient in whom the forehead was affected the lesions were multiple and in the tumor of the buttocks there were two distinct nodules. The tumors grow and expand into the subcutaneous tissues but are usually adherent to the epidermis. In three cases the overlying epidermis was elevated and discolored a bluish purple. The tumors ranged from 0.5 to 11 cm. in diameter and were surrounded in all cases by a distinct capsule, an unusual feature in simple angiomas. The duration varied from six weeks to four years, the usual symptom being a gradually enlarging painless tumor. No
FIGS. 17A AND B. HIGH-POWER PHOTOMICROGRAPHS FROM THE CASE SHOWN IN FIGS. 15 AND 16

The upper illustration depicts the angiocavernous areas of the tumor and the lower the ganglion-like cells described by Masson, which resemble those found in benign melanomas.

extensions or metastases were noted in the solitary nodules treated by excision. In the instance of multiple tumors on the forehead there was no response to irradiation over a period of four months.

The excised tumors show a conglomeration of vascular cysts which are distinctly encapsulated. Under the microscope are seen numerous
cavernous angiomatous spaces lined by endothelium and surrounded by areas of benign basal-cell adenoma. Here and there the proliferating basal cells may show papillary projections into the cavernous spaces. (Figs. 20 and 21.)
MALIGNANT VASCULAR LESIONS

The pathologic conception of malignant tumors of the blood vessels (endotheliomas) has been constantly narrowed since the description of numerous tumors within this category in the past century. Many of the lesions formerly described as hemangio-endothelioma, peri-
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FIG. 22. PHOTOMICROGRAPH SHOWING NEWLY FORMED CAPILLARIES IN METASTASIZING ANGIOMA. PATH. NO. 54354
Secondary deposits were found in the lungs, heart, spleen, and adrenals.

FIG. 23. PHOTOMICROGRAPH FROM CASE SHOWN IN FIG. 22, SHOWING PROLIFERATION OF TIGHTLY PACKED SPINDLE CELLS SURROUNDING CAVERNOUS SPACES FILLED WITH RED BLOOD CELLS
Courtesy of Dr. S. M. Rabson, New York.

thelioma, cylindroma, and perithelial angiosarcoma may be reclassified as metastatic lesions of the thyroid or kidney, or as secondary deposits from non-pigmented malignant melanomas. Some of the tumors of the soft parts previously classified as angio-endotheliomas in this laboratory are now recognized as adenocystic basal-cell cancers, as aberrant benign mixed tumors of salivary type, and as glomic tumors. Three groups of malignant vascular lesions are retained in this category with a fair degree of assurance. These include metastasizing
hemangiomas, primary angiosarcoma of the liver in infants (malignant hepatic angioblastoma), and Kaposi's hemorrhagic sarcoma of the skin.

Metastasizing Angiomas and Malignant Hepatic Angioblastomas: Superficial cellular angiomas of the angioblastic variety which have been present as benign growths for many years may show marked activity following trauma and metastasize widely. The secondary lesions closely resemble the primary tumor in pattern, making it difficult under the microscope to distinguish a benign cellular angioblastoma from one undergoing malignant change. One case belonging to this group is recorded in the Surgical Pathological Laboratory. This metastasizing angioma was referred by Dr. S. M. Rabson of New York City. The patient was a male aged sixty-two. The largest masses were in the iliac fossae and in the liver. Necropsy disclosed, in addition, metastases to the heart, sternum, vertebral column, lungs and pleura, spleen, and adrenals. The tumor was composed of tightly packed spindle cells surrounding cavernous and capillary angiomatous spaces (Figs. 22–23). Typical cases of metastasizing angioma which are generally accepted in the literature are those of Borrmann, Ullmann, Pick, Stamm, and Kopp, cited by Sonntag.

Three primary sarcomas of the liver of angioblastic nature are recorded in the laboratory (Fig. 24). The patients were infants nine months, two years, and two and a half years of age, and all three cases terminated fatally. Jorge and Brachetto-Brian reported a similar case in an infant and were able to find reports of 4 previous cases in children and 13 in adults. The hepatic enlargement is accompanied by ascites,
FIG. 25. Gross specimen from an arm amputated for Kaposi's Hemorrhagic Sarcoma making its primary appearance in the subcutaneous tissues on the flexor surface of the forearm. Path. No. 45402

FIG. 26. Photomicrograph showing the perivascular proliferation of malignant spindle cells from the case shown in Fig. 25
and in most instances death from shock has followed exploration of the new growth. Under the microscope the lesions are seen to have a loose myxomatous stroma with capillary and cavernous areas. The tumors are smooth and of mottled yellow red appearance, and may pervade the entire liver. Metastases did not occur in our cases.

**Hemorrhagic Sarcoma of the Skin, Kaposi's Disease:** Hemorrhagic sarcoma of the skin, originally studied by Kaposi, begins with a series of multiple cutaneous lesions, blue or red in color. By some authors the initial lesions are considered inflammatory. Subsequently the nodules increase rapidly in size and number, extending over the body and extremities, with fatal termination. Three such cases are recorded in this laboratory. The first patient, a white woman aged fifty-three,
mittent swelling and pain in the left leg, of eighteen years' duration. Hemorrhagic areas appeared over the thigh, and the swelling increased, extending to the groin. A Kondoleon operation was performed in January 1932, and the patient was reported dead of pneumonia six weeks later. No necropsy was performed.

The third case occurred in a man of fifty-six with multiple hemorrhagic nodules, bluish in color, on the face, neck, and head. Biopsy revealed a lesion typical of Kaposi's disease. The patient is still under treatment.

Under the microscope the lesions of Kaposi's sarcoma are composed of vascular spaces, with and without endothelial lining, in which numerous red blood cells are intermingled with large malignant spindle cells containing nuclei of varying sizes and density. Histologically the lesion is best classified as an angiosarcoma.

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