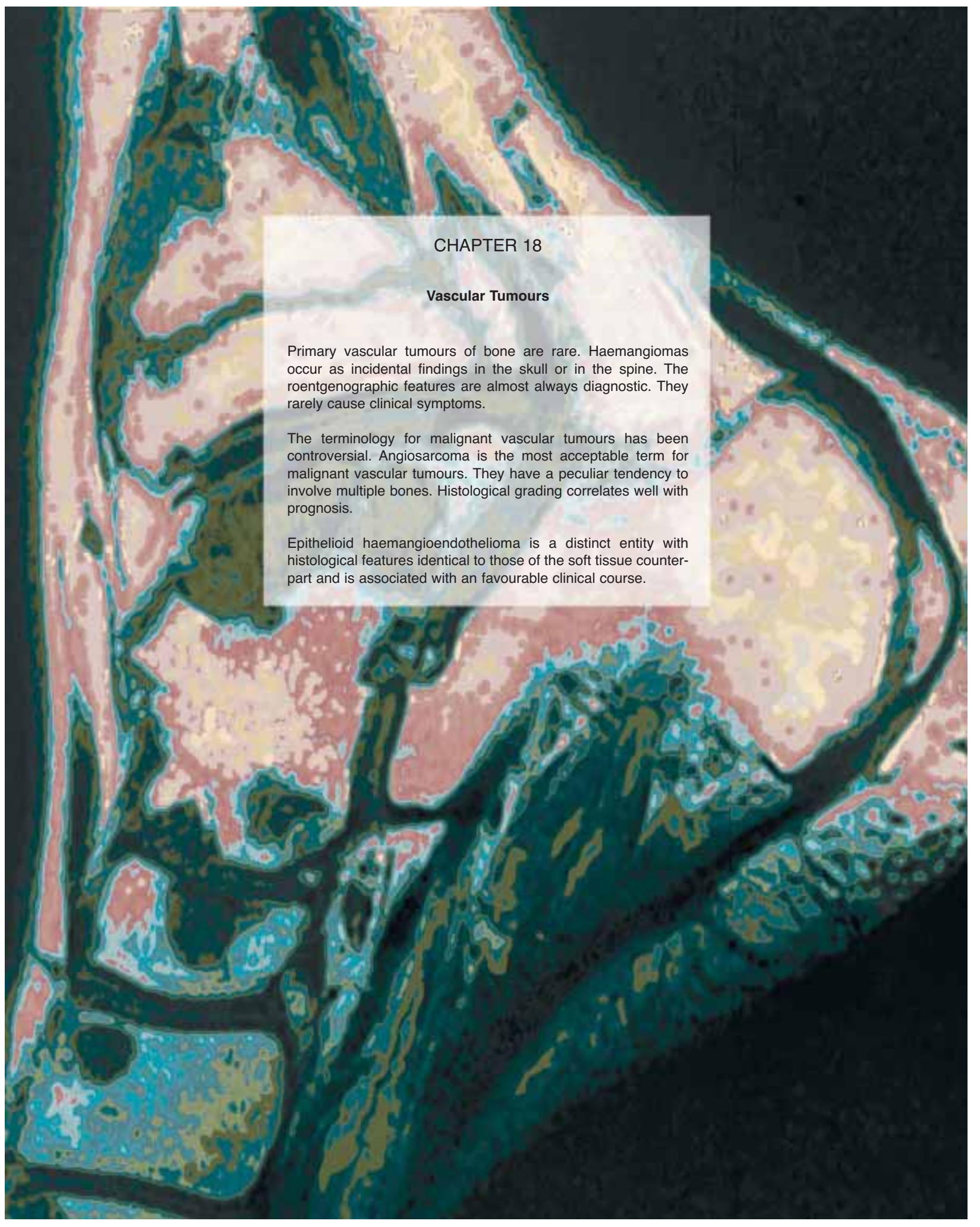

CHAPTER 18

Vascular Tumours

Primary vascular tumours of bone are rare. Haemangiomas occur as incidental findings in the skull or in the spine. The roentgenographic features are almost always diagnostic. They rarely cause clinical symptoms.

The terminology for malignant vascular tumours has been controversial. Angiosarcoma is the most acceptable term for malignant vascular tumours. They have a peculiar tendency to involve multiple bones. Histological grading correlates well with prognosis.

Epithelioid haemangioendothelioma is a distinct entity with histological features identical to those of the soft tissue counterpart and is associated with an favourable clinical course.

Haemangioma and related lesions

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Definition
A benign vasoformative neoplasm or developmental condition of endothelial origin.

ICD-O code 9120/0

Synonyms
Capillary haemangioma, cavernous haemangioma, venous haemangioma, angioma, histocytoid haemangioma, angiomatosis.

Epidemiology
Haemangiomas are relatively common lesions; autopsy studies have identified them in the vertebrae of approximately 10% of the adult population {18}. However, clinically significant symptomatic tumours are very uncommon and account for less than 1% of primary bone tumours {539}. Haemangiomas occur at any age, but most are diagnosed during middle and late middle age with the peak incidence in the 5th decade of life {1875}. The male to female ratio is about 2:3 {18,539,1875,2153,2249}.

Sites of involvement
Vertebral bodies are the most common site, followed by the craniofacial skeleton, and then the long bones where they tend to involve the metaphyses {18,539,2249}.

Clinical features / Imaging
The majority of haemangiomas, especially those arising in the spine, are incidental radiographic findings. However, large vertebral tumours may cause cord compression, pain and neurological symptoms. Symptomatic tumours occuring elsewhere are painful and may cause a pathologic fracture. Haemangiomas present as a well demarcated lucent mass that frequently contains coarse trabeculations or striations. In flat bones like the calvarium, the tumour is expansile and lytic and produces a sunburst pattern of reactive bone formation. Clinically, indolent lesions frequently contain fat and sclerotic trabeculae on CT and MRI. Symptomatic tumours usually show loss of fat and reveal a low signal on T1-weighted images and a high signal on T2 {539,644,1280,1354,1875,2287}.

Macroscopy
Haemangioma manifests as a soft well demarcated dark red mass. It may also have a honey-comb appearance with intralesional sclerotic bone trabeculae and scattered blood-filled cavities.

Histopathology
Haemangiomas have variable histological features. Capillary and cavernous haemangiomas are composed of thin-walled blood-filled vessels lined by a single layer of flat, cytologically banal endothelial cells. The vessels permeate the marrow and surround preexisting trabeculae. When capillary or cavernous haemangiomas involve a large localized

Table 18.01
Variants of haemangiomas.

Haemangioma:
cavernous,
capillary,
epithelioid,
histiocytoid,
sclerosing
Papillary vegetant endothelial proliferation (Masson type)
Angiolymphoid hyperplasia with eosinophilia (Kimura disease)
Angiomatosis:
non-aggressive: regional,
disseminated: cystic angiomatosis
aggressive: massive osteolysis (Gorham-Stout syndrome)
Osseous glomus tumour (glomangioma)
Lymphangioma
Lymphangiomatosis

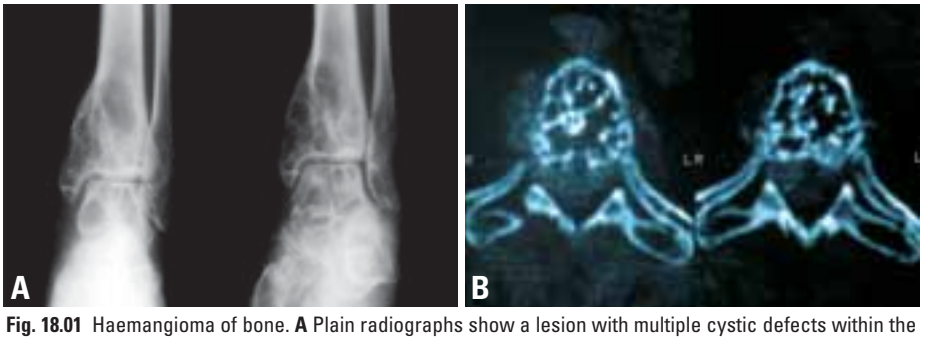

Fig. 18.01 Haemangioma of bone. **A** Plain radiographs show a lesion with multiple cystic defects within the distal tibia. **B** CT cross-sectional appearance of a vertebral haemangioma where the coarse trabeculae result in a "polka-dot" pattern.

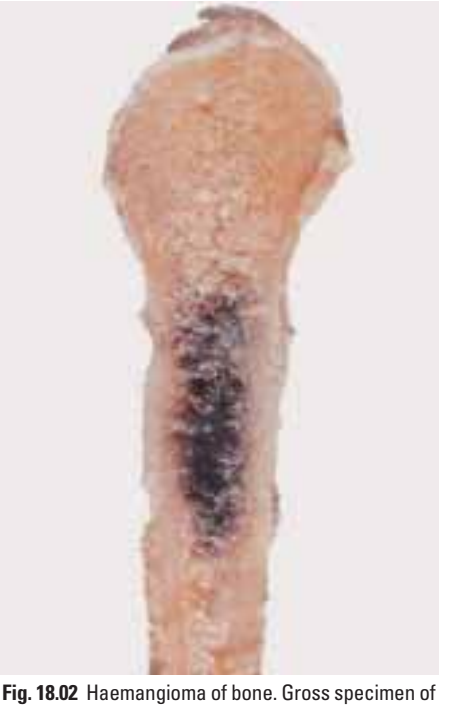

Fig. 18.02 Haemangioma of bone. Gross specimen of a tumour of the proximal fibula with a focus of brown-red appearance without marginal sclerosis.

Fig. 18.03 Haemangioma of bone. The radiated spicules are demonstrated on this macerated specimen.

region or are widespread throughout the skeleton, it is known as angiomatosis. Gorham disease may be associated with a histological picture that resembles haemangioma. Epithelioid haemangioma is composed of large polyhedral neoplastic endothelial cells that have vesicular nuclei and abundant eosinophilic cytoplasm. Some tumour cells have round clear cytoplasmic vacuoles that may contain intact or fragments of red blood cells. Vacuoles in neighbouring cells often fuse forming vascular lumena. The epithelioid cells may line well formed vascular spaces or grow in solid cords or sheets. The stroma consists of loose connective tissue and may contain a mixed inflammatory infiltrate including eosinophils.

The vessels in lymphangioma are dilated, sinusoidal, filled with lymph fluid and lined by a single layer of flat, banal endothelial cells. The surrounding stroma may contain lymphocytes.

Immunophenotype

The endothelial cells uniformly express vimentin and many cells stain with antibodies to F. VIII, CD31, and CD34. Epithelial haemangiomas may also express keratins and EMA. FLI1 has also been observed in haemangiomas.

Ultrastructure

The endothelial cells contains Weibel-Palade bodies. Cytoplasmic filaments are abundant in epithelioid endothelial cells.

Prognostic factors

Haemangiomas have an excellent prognosis and have a low rate of local recurrence. Progression to an angiosarcoma is an extraordinarily rare event {528,611, 641,649,1628}.

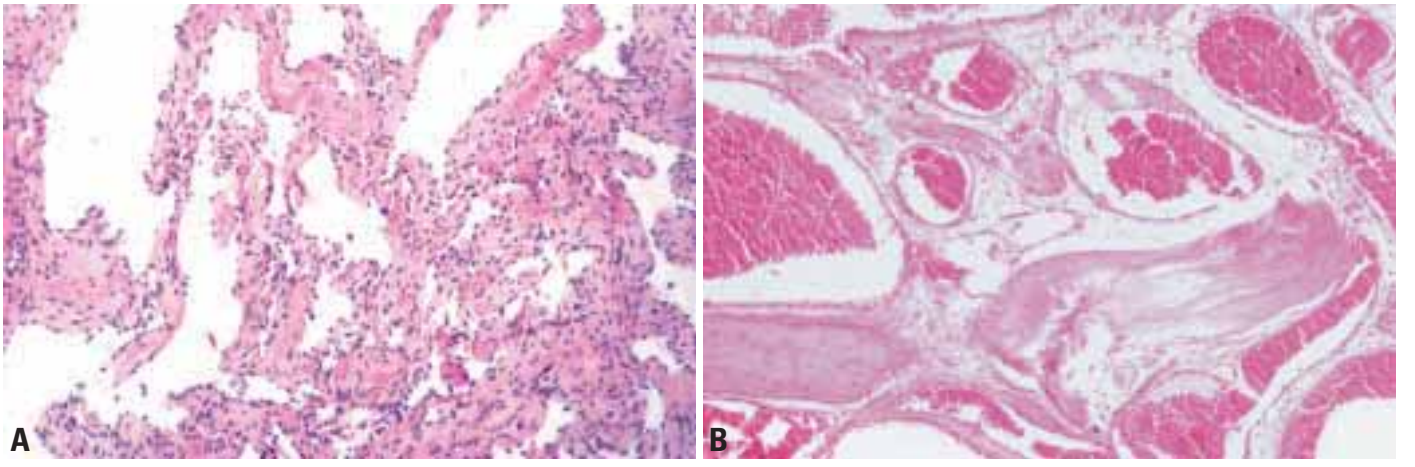

Fig. 18.04 Haemangioma of bone. **A** This bony haemangioma shows the morphology commonly associated with cavernous lesions which have been curetted. The spaces often become collapsed, and blood is no longer present because of the processing. **B** Histological pattern of a cavernous haemangioma showing broad thin-walled blood vessels, lined by a single layer of flat endothelial cells and filled with blood, within the medullary cavity between the bone trabeculas.

Angiosarcoma

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Definition
Angiosarcomas of bone are composed of tumour cells which show endothelial differentiation.

ICD-O code 9120/3

Synonyms
Haemangiosarcoma, haemangioendothelioma, haemangioendothelial sarcoma, epithelioid angiosarcoma.

Epidemiology
Malignant vascular tumours of bone are very rare and account for less than 1% of malignant bone tumours. Age distribution shows a wide range with nearly equal distribution from the second to the eighth decade. Epithelioid haemangioendothelioma tends to occur during the second and third decades of life. Males and females are affected approximately equally.

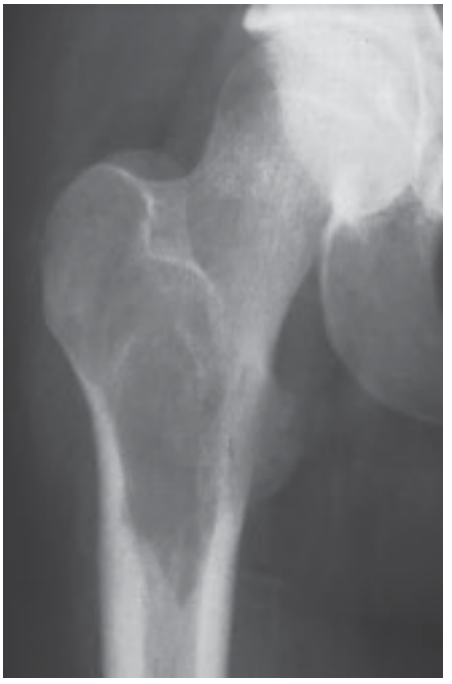

Fig. 18.05 Angiosarcoma. Plain X-ray of a tumour involving the proximal femur, featuring a purely lucent destructive process in the intertrochanteric region. The radiological appearance is nonspecific.

Sites of involvement
Malignant vascular tumours of bone show a wide skeletal distribution. They tend to affect the long tubular bones of the extremity and the axial skeleton, mainly the spine. These tumours reveal the tendency to develop multicentric lesions in bone. About a third of these lesions are multifocal.

Clinical features / Imaging
Malignant vascular tumours most commonly present as painful lesions which may be associated with a mass. Angiosarcoma usually develops purely lytic bone lesions. They are poorly marginated but can occassionally have a sclerotic rim. A soft tissue mass is often associated with less well differentiated tumours. The radiological appearence of epithelioid hemangioendothelioma is also non-specific. They also present as purely lytic lesions with varying degrees of peripheral sclerosis. Although the radiographic feature of malignant vascular tumours of bone are nonspecific, clustering of multifocal lesions in a single anatomic location suggests the diagnosis of a vascular neoplasm.

Aetiology
Angiosarcomas may arise at sites of prior radiation {338,452,1716}. The aetiology of the majority of malignant vascular tumours is unknown.

Macroscopy
Angiosarcomas are bloody and generally firm in their consistency. Necrosis is generally not observed. Epithelioid haemangioendotheliomas tend to be firm and tan-white. Both tumours can erode the cortex and extend into the soft tissue.

Histopathology
Tumour cells forming vascular spaces constitute the general histological feature of angiosarcoma of bone. Angiosarcoma of bone shows a wide range of histology, ranging from well differentiated cases mimicking haemangioma to poorly differentiated tumours which may be difficult to identify as a vascular tumour. Histo-logically, reactive bone formation can sometimes be observed in angiosarcoma of bone. This is more pronounced in the periphery, but can also be found in the more central portions of the lesion.
Poorly differentiated angiosarcomas are composed of more atypical endothelial cells. They exhibit very prominent nu clear atypia and a considerably increased number of mitoses with atypical mitotic figures. Formation of intraluminal buds can often be observed. Areas with necroses may be present. Some tumours may show epithelioid cytological features and mimic the appearance of metastatic carcinoma. Others show spindle cell cytological features and mimic other primary bone sarcomas.
Epithelioid haemangioendothelioma is composed of anastomosing cords, solid nests, and strands of endothelial cells that may sometimes form narrow vascular channels. The small capillary-sized tumour vessels can mimic small reactive vessels of granulation tissue. The epithelioid cells tend to have eosinophilic cytoplasm which may show vacuolization and sometimes signet ring-like appearance. Of remarkable significance is the

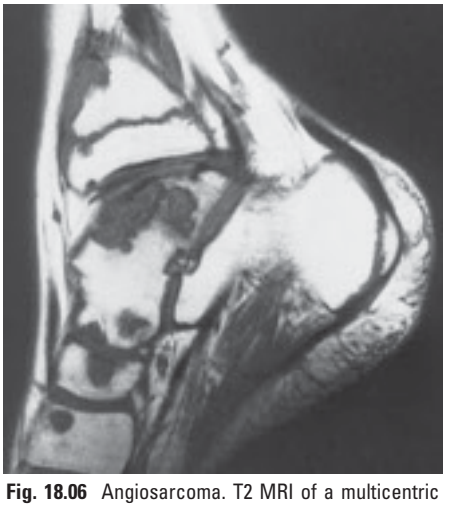

Fig. 18.06 Angiosarcoma. T2 MRI of a multicentric tumour involving multiple bones of the foot.

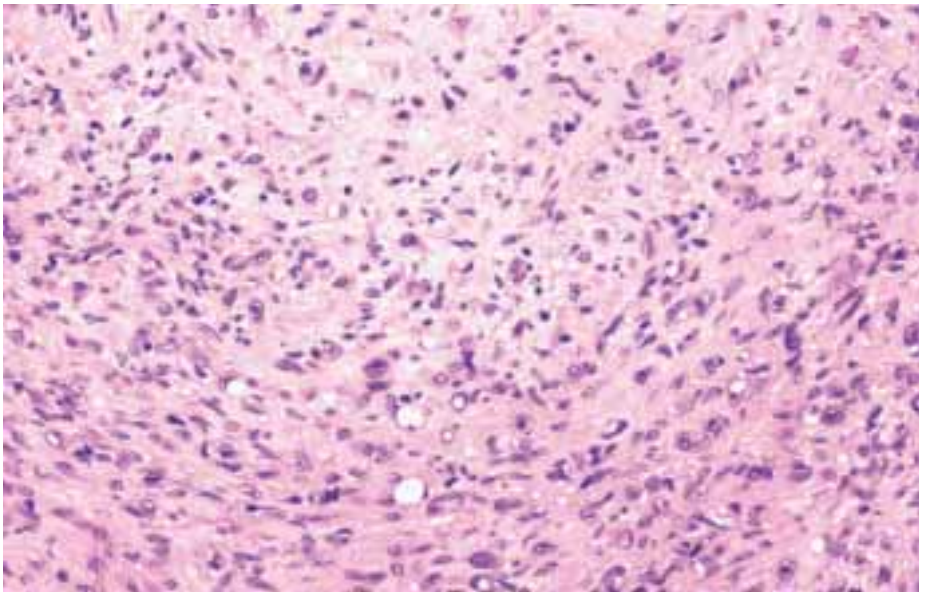

Fig. 18.07 Epithelioid haemangioendothelioma. The tumour cells are arranged in a cording fashion in a myxoid stroma. Note the occasional cytoplasmic vacuoles.

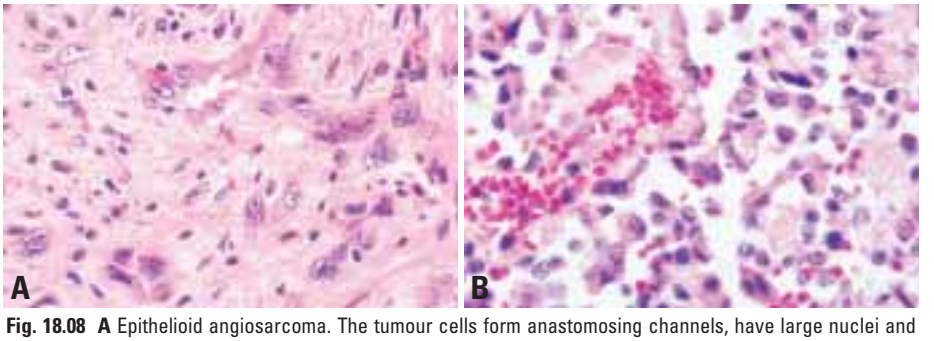

Fig. 18.08 **A** Epithelioid angiosarcoma. The tumour cells form anastomosing channels, have large nuclei and prominent nucleoli. **B** High grade angiosarcoma showing atypical cells with poorly formed papillae present within spaces.

myxoid and hyalinized appearance of the connective tissues stroma. The nuclei of the neoplastic cell show varying degrees of pleomorphism and anaplasia.

Immunophenotype

The endothelial cells uniformly express vimentin and many cells stain with antibodies to Factor VIII, CD31, CD34, and Ulex Europaeus. Epithelioid malignancies may also express cytokeratins and EMA {1134,2249}.

Ultrastructure

The endothelial cells contain Weibel-Palade bodies, but are generally difficult to find in poorly differentiated tumours. Cytoplasmic filaments are abundant in epithelioid neoplasms.

Genetics

Two epithelioid haemangioendotheliomas have shown an identical chromosomal translocation involving chromosomes 1 and 3 {1403}.

Prognostic factors

The histological degree of differentiation is the most significant factor in the prognosis of patients with malignant vascular tumours of bone {300,2288}. Some studies have also suggested that multifocal tumours show a survival advantage. This survival advantage may in part be related to the multifocal tumours showing better differentation {1134,2142}.