Giant-cell tumour of the tendon sheath (GCT-TS) is a benign solitary tumour which usually arises in the limbs. It occurs most often in the hand where local recurrence after excision has been reported in up to 45% of cases. It is less common in the foot where the biological behaviour and risk of local recurrence have not been defined. We have studied 17 cases of GCT-TS of the foot and ankle in which treatment was by excision. Fifteen presented as a solitary, painless, slow-growing soft-tissue swelling. One lesion was associated with sensory deficit of a digital nerve and one with pain on walking. Thirteen cases originated from the periarticular tendon-sheath complex of the small joints of the toes and four from the capsule or long tendons of the ankle. A correct preoperative diagnosis was made in only three cases. MRI proved to be the most useful preoperative investigation as GCT-TS has a characteristic appearance which allows planned local excision to be carried out. None of the patients with histologically confirmed GCT-TS required further surgery. There was no local recurrence in 15 patients who were available for follow-up at a mean of 85 months.

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Giant-cell tumour of the tendon sheath (nodular tenosynovitis, localised villonodular synovitis, fibrous histiocytoma of the synovium; GCT-TS) is a solitary benign soft-tissue tumour of the limbs. It typically presents as a localised tumour arising from the complex of the tendon sheath of small joints of the hands and feet. The lesion contains fibroblasts, macrophages, including collections of foamy macrophages and scattered macrophage polykaryons, and deposits of haemosiderin. GCT-TS is distinguished from pigmented villonodular synovitis which usually arises from the synovial membrane of a joint.

GCT-TS of the hand is a well-described entity in which there is a reported local rate of recurrence of up to 45% after excision. Adjuvant radiotherapy is recommended if there is a high risk of recurrence or when there has been incomplete excision of a histologically aggressive tumour with involvement of bone. Although it occurs much less frequently in the foot, this is the second most common anatomical site. No previous study has reviewed the clinical presentation, treatment and outcome, including the local rate of recurrence, after surgery for GCT-TS in the foot and ankle. We have identified 17 cases of GCT-TS of the foot and ankle and review the clinical findings.

Patients and Methods

From the Oxford Tumour Registry we identified 22 cases of GCT-TS of the foot and ankle which had been treated by excision between January 1982 and December 1999. Seventeen had complete records. The gender and age of the patients at presentation, the clinical features, investigations, preoperative diagnosis, operative findings, the anatomical site of origin of the tumour, the treatment and complications, including recurrence, were recorded. Table I gives the details of the patients.

Results

Site of origin. Thirteen cases involved the foot and four the ankle. There were ten females and seven males with a mean age of 29.2 years (8 to 53). Of the cases arising in the foot, seven involved the right and six the left; six involved the great toe. The remaining cases were in the ankle and were equally distributed among both feet.

The operative notes indicated the precise anatomical location of the lesion and its macroscopic appearance. Of the four cases involving the ankle, two originated from the capsule and two from a long tendon sheath (tibialis posterior and peroneus tertius). The anatomical site of the lesions is summarised in Figure 1.
Clinical features. Fifteen patients presented with a painless, solitary swelling and two had discomfort on weight-bearing since the tumour was on the plantar aspect of the great toe. There was difficulty with footwear in four and limitation of walking in one. One had symptoms of compression of a digital nerve. In two there was a history of trauma directly preceding the appearance of the mass. The mean duration of symptoms before presentation in 15 patients was 28 months (6 months to 8 years).

Radiological and pathological findings. Six patients had no imaging and 12 had had preoperative radiography of the foot and ankle. In eight the radiological findings were those of a soft-tissue mass adjacent to digital small bones or bones of the tarsus. Soft-tissue calcification of the tumour was seen in two patients and cortical erosion of the underlying small bones was evident in four.

Further preoperative investigations were undertaken in four patients. One underwent CT of the ankle and three had MRI (Fig. 2). One (case 14) presented with pain in the ankle and radiological evidence of cortical erosion of the talus. MRI of the ankle showed a solid lobulated lesion abutting the subtalar joint and sinus tarsi. In one (case 17), there was speckled calcification of the tumour on the radiograph of the ankle with features similar to those of a synovial sarcoma. MRI confirmed that the lesion abutted the subtalar joint. There was variable signal intensity and signal voids which represented areas of calcification within the solid tumour. There was no associated bony destruction. On the basis of MRI and plain radiography, synovial sarcoma, nerve-sheath tumour and pigmented villonodular synovitis were considered in the differential diagnosis. A trucut biopsy was undertaken to exclude a soft-tissue sarcoma and confirmed the diagnosis of GCT-TS.

The histopathological changes in all cases were typical of GCT-TS with the presence of numerous fibro-
blasts, macrophages and scattered giant cells. In 11 of the 17 lesions there was prominent deposition of haemosiderin.

Outcome after surgical excision. There was no local recurrence after local or wide excision of the tumour. There were two cases of superficial wound infection and one of digital nerve palsy after excision. One patient (case 11) had amputation of the little toe for a presumed diagnosis of chondrosarcoma based on the preoperative clinical and radiological appearances. Histopathological examination confirmed the presence of an aggressive giant-cell tumour of the extensor tendon sheath with microscopic intramedullary extension into the adjacent proximal phalanx.

Discussion

GCT-TS is a benign soft-tissue tumour of the limbs which arises from the complex of the tendon sheath and periarticular soft tissues of small joints. It occurs most commonly in the fingers and less so in the ankle and foot, although the latter is the second commonest site. In a study of 188 cases of GCT-TS, 77% were found in the hand and only 3% in the foot. A recent study of 207 cases showed that 25 arose in the toes and ten in the ankle and large joints of the foot.

In our study, we found that GCT-TS of the foot and ankle occurred over a wide age range. Like GCT-TS of the hand, it was found principally in young adults (mean age 29 years). The lesion arose most commonly in the forefoot, especially in the great toe. Right and left feet and plantar (flexor) and dorsal (extensor) aspects of the foot were equally affected. The clinical features and mode of presentation of GCT-TS of the foot and ankle were found to be similar to those of the hand. In most cases, the lesion presented as a slow-growing, painless, firm mass. A history of preceding trauma, which is thought by some observers to be of pathogenic significance in the development of GCT-TS of the hand, was noted in only two patients. Neurological symptoms are not a common feature of GCT-TS of the hand and a sensory deficit was reported by only one patient in our study. This finding suggests that if there is pain or neurogenic symptoms with a solitary lesion of the foot a nerve-sheath tumour or soft-tissue sarcoma should be more strongly considered in the differential diagnosis.

In GCT-TS of the hand, there is an incidence of 11% of bony involvement. In our series, of the nine patients who had preoperative radiography, four showed bony involvement with erosion of the adjacent bone in three and bony destruction in one. Two also had soft-tissue calcification, a feature which can be seen in vascular tumours and some soft-tissue sarcomas, notably synovial sarcoma.

MRI of the foot and ankle allows soft-tissue tumours to be assessed anatomically and was found to be helpful in the preoperative diagnosis. In our study, four patients had MRI or CT to assess the anatomical and radiological features of the tumour. It was noted that the fine haemosiderin granules and the abundant matrix collagen in the lesions caused a decrease in the MRI signal, particularly in the T2-weighted image. Administration of the contrast agent, gadopentetate dimeglumine, characteristically enhanced the T1-weighted image. These appearances helped to differentiate GCT-TS from other solid soft-tissue tumours of the limbs, such as nerve-sheath tumours, haemangioma and soft-tissue sarcoma.

Although local recurrence has been reported in up to 45% of cases, in most series the incidence of local recurrence in the hand has been reported as between 10% and 20%. In general, these tumours recur if incompletely excised. Recurrent lesions are often more highly cellular and have increased mitotic activity. The incidence of local recurrence after surgery for GCT-TS of the foot and ankle...
has not previously been determined. In our study, we found that there was no recurrence after surgery (marginal or local excision with a small cuff of normal tissue) in the 15 cases which were available for long-term follow-up. There were no cases of malignancy (malignant giant-cell tumour of tendon sheath). 3,8 A history of trauma preceding development of GCT-TS in the hand has been noted in some cases and, on this basis, it has been proposed that it is a reactive lesion caused by trauma. In a retrospective study of 28 cases of GCT-TS of the hand, a history of trauma was noted in 21% of cases 9 and a rate of recurrence of 25%, occurring at a mean of 27 months after excision. In our series a history of trauma was noted in two cases of GCT-TS of the foot; there was no recurrence in these cases.

GCT-TS is histologically similar to pigmented villonodular synovitis. Both lesions are characterised by the deposition of haemosiderin and there are usually numerous macrophages, including foamy macrophages, and scattered macrophage polykaryons. The pathogenesis is uncertain. Aneuploid cells have been noted by DNA flow cytometry in a significant number of cases. 10 Grover et al. 11 in a study of 52 cases of GCT-TS of the hand, investigated the expression of nm23 using immunohistochemical techniques on paraffin sections. Absence of this gene in 21% of these tumours was found to correlate strongly with a statistically significant risk of local recurrence. Clonal abnormalities, including a translocation involving chromosomes 1, 2 and 16, have also been noted in GCT-TS. 3,12,13

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References