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treatment was closed in 5 cases with minimal displacement and surgical in the remaining 4 with a severe displacement.

The mechanism of this juvenile fracture is well known; the keystone is the peculiar closure pattern of the distal tibial physis, which makes the lateral corner a weakened portion for a period of 18 months until complete closure occurs (Rang 1974). Injuries with the foot in external rotation and extension lead to avulsion of this physeal portion, due to excessive tension of the tibio-fibular ligament.

In displacements exceeding 2 mm with a rotation of the fragment, open reduction and internal fixation have been suggested to obtain articular congruence (Stefanich and Lozman 1986, Mariani and Perrone 1998). Schlesinger and Wedge (1993) described percutaneous fixation of the displaced fragment.

As to our patient, we were concerned about the quality of bone in the dislocated fragment, hence the possibility of obtaining good osteosynthesis with an anatomical reduction. The fragment was moderately porotic, but reduction and stable synthesis were possible.

Another risk that had to be taken into account was avascular necrosis (AVN) of the fragment, which is theoretically increased by a delayed diagnosis and treatment. We found no sign of necrosis when we removed the screw and at the final follow-up, the boy had no symptoms.

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Fibrosarcoma at the site of a metallic fixation of the tibia—a case report and literature review

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A 58-year-old man who was seen in April 1996 complained of pain and swelling along the medial aspect of the left calf for 4 days after a fall. 30 years earlier, his left tibia had been plated after a fracture. The patient had had no symptoms up till then. Radiographs showed a well-healed fracture of the tibia, with a plate and 4 screws (Figure 1). A hematoma was diagnosed. The discomfort gradually increased. 1 week later, an open drainage incision was made. A culture for bacteria revealed no growth and the wound healed per primum.

2 months later, the swelling persisted and we thought it was due to the presence of the plate and screws. Therefore, we decided that these should be removed and a biopsy performed. There was no sign of macroscopic corrosion of the stainless steel implant. The pathologist reported that the soft tissue specimen consisted of fibrous tissue and old bleeding, without neoplastic cells. The benign diagnosis was confirmed at reexamination. The patient was discharged from hospital.

He was readmitted to hospital 9 months later with a tumor of about 5 cm in diameter having necrotic areas and a malignant appearance at the site of the previous scar (Figure 2). MRI showed a tumor in contact with the skin, but we were not told

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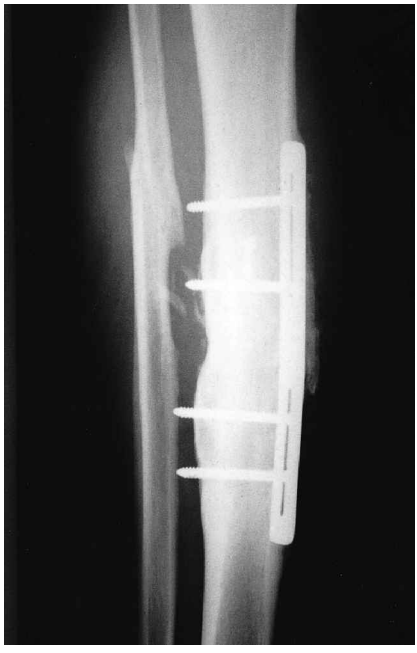

Figure 1. A healed fracture of the tibia, with a plate and 4 screws.

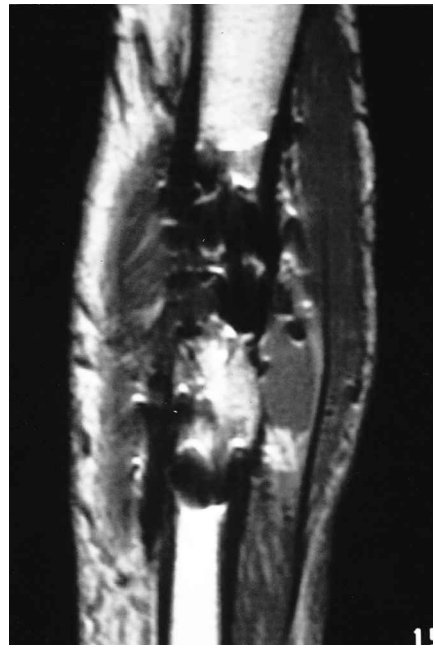

Figure 3. MRI shows a soft-tissue tumor in contact with the skin. Bone signal is altered because of postoperative changes.

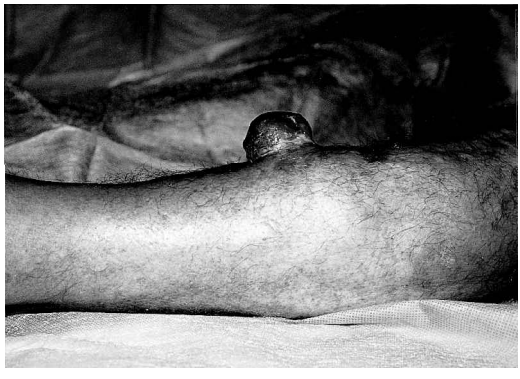

Figure 2. Ulcerated tumor along the medial aspect of the calf of about 5 cm in diameter with necrotic areas and malignant appearance.

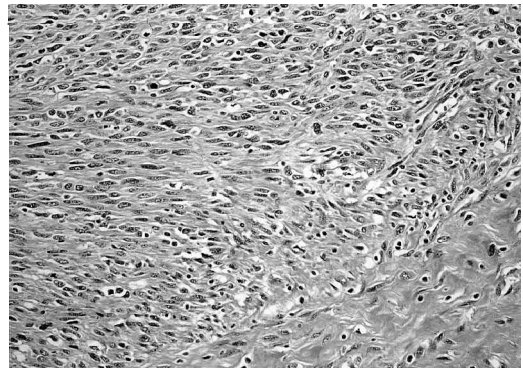

Figure 4. Interfase between probably reactive hypocellular areas and high-grade sarcomatous component, where cells show a high nuclear pleomorphism and high mitotic activity, HE ×250.

about bone invasion (Figure 3). Routine blood screening was unremarkable. Metastatic evaluation with a bone scan, pulmonary CT scan and abdominal ultrasonography were negative. The biopsy showed a high-grade sarcoma with fibroblastic cells with marked nuclear pleomorphism and high mitotic activity (Figure 4). An above-knee amputation of the left leg was performed. Dissection of the specimen showed a soft tissue tumor with some periosteal infiltration. The patient remains asymptomatic 2 years after the operation.

Discussion

Since the advent of internal fixation of fractures, and particularly since the implantation of joint replacement prostheses, the possible carcinogenic effects of metals and their alloys have been a subject of concern.

Experimentally, some metals such as cobalt (Heath 1956), chrome (Heath et al. 1971), and others have been shown to be carcinogenic on parenteral administration in animals or after im-

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Malignant neolplasms in the presence of metallic implants

Author	Year	Age	Site	Implant	Interval (yr.)	Histology
McDougall	1956	42	Humerus	Plate and screws	30	Ewing's sarcoma
Delgado	1958	40	Tibia	Plate and screws	3	Osteosarcoma
Dube	1972	84	Tibia	Plate and screws	36	Hemangioendothelioma
Tayton	1980	11	Femur	Plate and screws	7	Ewing's sarcoma
McDonald	1981	48	Tibia	Plate and screws	17	Malignant lymphoma
Dodion	1982	49	Femur	Plate and screws	1	Immunoblastic lymphoma
Lee	1984	58	Femur	Plate and screws	14	Malignant fibrous histiocytoma
Hughes	1987	42	Femur	Single screw	30	Malignant fibrous histiocytoma
Ward	1990	65	Femur	Smith-Petersen nail	9	Osteosarcoma
Khurana	1991	39	Femur	Intramedullary nail	13	Malignant fibrous histiocytoma

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plantation in bone (Memoli et al. 1986). A substantial difference in species susceptibility exists with regard to metal carcinogenicity. Furthermore, it has been difficult to extrapolate experimental results from animals to humans (Snibaldi et al. 1976, Gaetcher et al. 1977, Lewis and Sunderman 1996).

Experience with metal-induced carcinogenesis in humans is limited. Statistical analysis has shown a higher incidence of respiratory malignancies in industrial workers exposed to nickel dust or chromate compound inhalation (Ward et al. 1990).

Nevertheless, the oncogenic effect of implant materials remains a matter of controversy. About 20 reports of malignancies related to metallic joint prostheses have been reported (Vahey et al. 1995). There are only a few reports on the oncogenic activity near metallic fracture fixation devices in man (Table).

Evidence of a possible relationship between metallic implants and malignancies has been found in the high chromosomal aberration rate in cells adjacent to metallic implants (Case et al. 1996). Some soft-tissue pseudotumors near metallic implants have also been reported (Svensson et al. 1988, Jacobs et al. 1995).

A cohort study showed a higher incidence of tumors of the lymphatic and hematopoietic systems after hip arthroplasty (Gillespie et al. 1988), but other large cohort studies have failed to demonstrate that metallic implants play a major role in the cause of malignancies (Mathiesen et al. 1995, Nyrén et al. 1995, Coleman 1996, Gillespie et al. 1996, Lewold et al. 1996).

An association has been reported between internal fixations and a tumor in 10 cases (Table). The patients were 11 to 84 years old when the tumor was detected, and the time between the metallic implant and neoplasm ranged from 5 months to 36 years. Only the long observed latency period might explain why a malignant transformation following the implantation of metals is not reported more frequently (Vahey et al. 1995).

In the first report, McDougall (1956) put forward the possibility of the dissimilar metallic composition of the plate and screws and the difference in potential that existed between them as being a carcinogenic stimuli. Ward et al. (1990) said that metallic constituents interact with normal tissue and may produce substances that act as antigens which induce hypersensitivity reactions and malignant transformations.

On the other hand, some evidence suggests that the reported cases of malignancies at metallic implant sites may be due to chance. For instance, an osteosarcoma at the site of a previous fracture that had no fixation devices has been described (Berry et al. 1980) and some reports have shown the presence of a metastatic tumor at the site of a metallic implant. In these cases, the presence of the tumor is coincidental (Allain et al. 1998).

The presence of metals in the region of the tumor neither proves nor disproves carcinogenicity. It seems very difficult in any case to establish a cause-and-effect relationship between the metal implant and the adjacent malignant tumor.

Given the enormous number of metallic devices that are currently in place, the development of a malignant lesion appears to be a most unusal complication, and may be completely coincidental.

Nevertheless, malignancy at a metallic implant site should be considered in the differential diag-

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nosis of swelling or pain, not only near a joint prosthesis but also close to another metallic device. Lastly, we support the effort to establish a world register of all these cases (Graham Apley 1989) in order to learn the true incidence of this important complication.

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