Clinical and radiological aspects of idiopathic diabetic muscle infarction

RATIONAL APPROACH TO DIAGNOSIS AND TREATMENT

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The systemic effects of diabetes mellitus are well recognised. The heart, kidney, central and peripheral nervous systems, and the distal parts of the limbs are often the site of end-organ damage resulting from ischaemia. Infarction of large muscle groups in the limb, not associated with gangrene, is uncommon. There have been few reported cases other than radiological descriptions of diabetic muscle infarcts. While previous reports have illustrated some of the clinical and radiological characteristics of this condition, the paucity of published cases makes it difficult to determine the most appropriate methods of diagnosis and treatment.

During a five-year period we treated 14 patients with diabetes mellitus, aged from 32 to 59 years, who were referred to a musculoskeletal oncology service for suspected soft-tissue sarcoma, but were subsequently found to have a diabetic muscle infarct. Closed needle biopsy was performed in 13 without complications. In 12 patients, the symptoms resolved without surgical treatment.

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Diabetic muscle infarct (DMI) was first described in 1965 by Angervall and Stener¹ and termed 'tumoriform focal muscular degeneration'. They described two diabetic patients with focal muscular degeneration who had excision of a mass in the thigh which was suspected of being a soft-tissue sarcoma. Subsequently, there have been few cases reported in the literature and some of those have been described more than once.²⁻²⁰ DMI is a distinct entity, with

characteristic clinical and radiological findings. It is probably more common than has been previously recognised. Recommendations for treatment have come from institutions with limited experience of this condition.

During a five-year period, we evaluated 14 patients who were referred to an orthopaedic oncology service for suspected soft-tissue sarcoma of the lower limb and were subsequently diagnosed as having DMI. We wish to call attention to the condition which simulates sarcoma and to outline a rational approach for diagnosis and treatment based on a review of the literature and our experience.

Patients and Methods

We reviewed retrospectively the clinical and radiological presentation of 14 patients diagnosed as having DMI. There were eight men and six women with a mean age of 43 years (32 to 59). Diabetes mellitus had been diagnosed from two months to 20 years before referral. Ten were insulin-dependent and four were not (Table I). Three of the five patients who were taking oral hypoglycaemic agents had poorly controlled diabetes and, ultimately, were treated with injections of insulin. Seven patients had associated problems including five with peripheral neuropathy, five with hypertension, one with pancreatitis, two with the nephrotic syndrome, one with arterial insufficiency, and one with human immunodeficiency syndrome. In all patients the initial chief complaint was of pain in the thigh or calf. The duration of symptoms before seeking medical attention ranged from three to 36 weeks. Ten of the 14 patients who initially had pain and swelling of the limb also noted a soft-tissue mass in the affected area three to eight weeks after the onset of symptoms. Imaging studies performed before referral included plain radiography in all patients, MRI in 11, CT in six, technetium bone scanning in three and gallium scanning in one (Table I).

Tissue biopsy for histological examination was obtained from all patients, in 13 using a core needle (14G Tru-Cut Needle; Baxter Healthcare Corporation, Deerfield, Illinois) with local anaesthesia under sterile conditions without radiological assistance. Adequate tissue for diagnosis was obtained in 12 of the 13 patients. One patient had an open biopsy after initial core biopsy and another was referred after undergoing an open biopsy elsewhere.

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Table I. Details of the 14 patients diagnosed as having DMI

Case	Age (yr)	Gender	Type*	Duration of diabetic disease (yr)	Duration of symptoms at presentation (wk)	DMI location	Additional treatment	MRI	CT	Radioisotope bone-scan	Tru-cut biopsy	Open biopsy	Time to healing (wk)
1	45	F	IDDM	8	3	Thigh		Yes	No	No	Yes	No	6
2	59	F	NIDDM	15	4	Thigh		Yes	No	Yes	Yes	No	5
3	43	M	IDDM	17	6	Thigh		Yes	No	No	Yes	No	4
4	40	M	IDDM	8	3	Thigh		Yes	No	No	Yes	No	12
5	41	M	IDDM	5	8	Thigh		Yes	No	No	Yes	No	Unknown
6	32	M	IDDM	9	12	Calf	Resection of infarcted tissue	Yes	No	No	No	Yes	6
7	39	F	IDDM	13	7	Thigh	Manipulation of knee	Yes	Yes	Yes	Yes	Yes	4
8	53	F	IDDM	16	6	Thigh		No	Yes	Yes	Yes	No	6
9	35	F	NIDDM	<1	8	Calf		Yes	No	No	Yes	No	8
10	46	F	IDDM	9	4	Thigh		Yes	Yes	No	Yes	No	4
11	40	M	NIDDM	3	4	Thigh		Yes	No	No	Yes	No	6
12	43	M	NIDDM	<1	8	Thigh	Resection of infarcted tissue	Yes	Yes	No	Yes	No	8
13	36	M	IDDM	3	3	Thigh		Yes	Yes	No	Yes	No	6
14	55	M	IDDM	20	36	Thigh		Yes	Yes	No	Yes	No	8

* IDDM, insulin-dependent diabetes mellitus; NIDDM, non-insulin-dependent diabetes mellitus

Results

Physical examination of the patients showed swelling and tenderness in the involved thigh or calf in all cases. Two patients had associated erythema. In seven patients the passive range of movement of the knee or ankle was decreased secondary to pain. The mean passive arc of movement of the knee was 60° (10 to 110).

Imaging studies. Plain radiographs of the involved area showed only one instance of bony change. In five of the six patients who had CT, there was asymmetry of the muscle with diffuse oedema in the muscles of the involved compartment and a varying degree of obliteration of the fascial planes. In one patient, a distinct soft-tissue mass was noted, confined to the anterior compartment of the leg as well as a scalloping erosion of

the lateral cortex of the tibia. Of the patients who had MRI, T1-weighted images showed enlargement or fullness of the involved muscle or muscle group with obscuring of the fascial planes. The area of involvement of the muscle was isointense compared with surrounding uninvolved tissue. On T2-weighted images, increased signal intensity with surrounding oedema was seen in all 13 patients who had MRI. In particular, the marked involvement of non-contiguous muscle compartments assisted in distinguishing DMI from pyomyositis (Fig. 1). Three patients had total body bone radio-isotope scanning. Focal increased uptake during the vascular phase was noted in the soft tissue of the involved area in two; in the other the bone scan was normal.

Biopsy. One patient was referred after irrigation, debridement and biopsy of a suspected abscess since the patholo-

Fig. 1a

Fig. 1b

Case 4. Figure 1a – MR T2-weighted image (TR 2000, TE 90) of the proximal thigh of a 40-year-old man with insulin-dependent diabetes mellitus and a three-week history of pain in the left thigh with a mass. There is a diffuse increased signal and oedematous changes of muscle groups involving primarily the adductor compartment, as well as the anterior and posterior compartments of the left thigh. There are no changes within the muscles of the right thigh. Figure 1b – Seven months later the patient returned with complaints of pain and a mass involving the contralateral right thigh. T2-weighted images (TR 2700, TE 90) show oedema and enlargement of muscle groups involving all compartments of the right proximal thigh. The previous changes noted in the left thigh have resolved.

gist suspected a 'low-grade malignant histiocytoma'. Our review of the pathology did not support evidence of malignancy and was diagnostic of DMI. No complications from the procedure occurred in the 13 patients who had a core-needle biopsy.

Treatment. After establishing the diagnosis of DMI based on imaging studies and biopsy,¹³ patients were initially treated symptomatically (Table I). They received analgesics, as needed, and commenced range-of-movement exercises. In ten (77%), no further treatment was necessary and their symptoms gradually resolved. The patient who had an incisional biopsy at another institution was not treated by this protocol. Three patients had an operation other than core-needle biopsy. The first patient in the group had a core biopsy which showed findings consistent with DMI. We were then unfamiliar with this condition and therefore the patient also had an incisional biopsy to confirm the diagnosis of DMI and exclude infection. His knee was manipulated at the same time. Two patients who were treated symptomatically for a three-month period developed intractable pain and progressive loss of function. In one the range of movement of the knee was reduced from 0° to 80° to 0° to 30°. He was unable to work. Surgical resection of a portion of the vastus medialis muscle, which measured 17 × 8 × 3.5 cm, was performed. Two weeks later he had 95° of knee flexion and required no analgesics. He was able to return to work as an internist. Two years after operation he has regained a full range of movement in the knee and has no loss of function. The other patient who failed to respond to oral analgesics and physiotherapy had an equinus contracture of the ankle of 10°. His pain was not controlled by oral narcotics. He underwent resection of a portion of the lateral gastrocnemius muscle measuring 11.7 × 3.2 × 2.9 cm. Two weeks later he had a plantigrade foot, could walk without aids, and did not require narcotic analgesics. There were no complications resulting from biopsy, physiotherapy or excision.

Discussion

Spontaneous infarction of muscle in a diabetic patient was first reported by Angervall and Stone in 1965.¹ They had resected a painful mass in the thigh in two patients with diabetes mellitus who were suspected of having a sarcoma. Histological examination showed no evidence of malignancy, but they found areas of haemorrhagic necrosis surrounded by muscle which showed regressive changes and evidence of regeneration. They also observed pathological changes in the vessels and intraneural diabetic microangiopathy. Over the past 30 years, others have confirmed the histological characteristics of DMI which include in varying amount, haemorrhagic necrosis, regeneration of muscle fibres, active denervation, hyalinosis and thickening of the affected arterioles and capillaries, and lymphocytic infiltration.^{3-10,13-19}

Eight years after the initial report,¹ Banker and Chester³ described two additional cases of patients with diabetes mellitus who developed pain in the thigh followed by swelling and a palpable mass. Both had an excision biopsy, but required reoperation due to recurrent haemorrhage into the infarcted muscle. They concluded that biopsy and mobilisation of the limb were to be avoided since both of their patients treated in that fashion experienced repeated haemorrhage into the operation site and required blood transfusion. Reports for the next 20 years continued to advise against biopsy and/or physiotherapy.^{2,8,10-12,17,18} Among our patients there were no complications resulting from percutaneous core-needle biopsy. Recent reports^{5,9,10,13,14,17} have suggested that incisional biopsy appears less likely to produce bleeding complications than the technique of excisional biopsy used by Banker and Chester.³ Our study supports the view that activity does not significantly delay recovery.

In a diabetic patient with muscle pain and/or a palpable mass, the differential diagnosis should include muscle infarct, abscess, focal polymyositis, osteomyelitis, occlusive vascular disease and soft-tissue sarcoma. The history can be helpful in that soft-tissue sarcomas are typically painless while DMI is painful. Laboratory tests are of limited value. The level of creatine kinase, while only increased in about 50% of patients with DMI, can help to distinguish DMI from polymyositis.⁴ This may be of value, since the histological appearance of polymyositis can mimic that of DMI.²¹⁻²³ The WBC is of limited help. While often elevated in infectious conditions, it may remain normal or be increased in cases of muscle infarct.^{5,10,18} In our study, it was greater than $10 \times 10^3/\text{mm}^3$ in two of five patients.

The most useful imaging tool is MRI.^{2,4,7,11,16,18,19,24} The increased signal intensity of the affected area on T2-weighted sequences is thought to be the result of the increase in tissue water that accompanies infarction. MRI can also provide a safe non-invasive technique to rule out deep-venous thrombosis.¹⁹ As we have gained experience with interpreting MRI in patients with DMI, we believe that the investigation may be diagnostic and biopsy is not always necessary. This is especially true in patients who present with recurrent infarcts in the contralateral limb as in case 4 (Table I). While MRI is very helpful in limiting the differential diagnosis and localising the lesion, it may not suffice to distinguish a DMI from a neoplastic process or infection.^{5,10,13,14,16,18} In such cases a core-needle biopsy of the muscle is indicated to obtain material for histological evaluation and microbial cultures.^{5,9,10,13,14,17}

The treatment of DMI is by analgesics and physiotherapy. In most cases, symptoms will resolve spontaneously without the need for surgery.^{3-5,10,12,13,18} Two of our patients, however, who had initially been treated by physiotherapy and oral narcotics, failed to improve. Both then had surgical resection of the involved muscle and a noted dramatic decrease in pain and improved function within two weeks. As many as half of the patients with

DMI in one site may experience additional muscle infarction involving the original or contralateral limb.^{3,5,17,18} We observed recurrence in only one patient. As a tertiary referral centre, we may have observed this low number of recurrences because of subsequent recognition and treatment of DMI by the primary care physician.

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