CASE REPORT

PAINFUL SWELLING OF THE THIGH IN A DIABETIC PATIENT: DIABETIC MUSCLE INFARCTION.

P. LAFFORGUE (1), B. JANAND-DELENNE (2), V. LASSMAN-VAGUE (2), V. DAUMEN-LEGRÉ (1), T. PHAM (1), P. VAGUE (2)

SUMMARY - A 44-year-old woman with a 5-year history of poorly controlled Type 1 diabetes mellitus presented with a painful, firm and warm swelling in her right thigh. Pain was severe but the patient was not febrile, and had no history of trauma or abnormal exercise. Laboratory tests showed ketoacidosis, major inflammation (erythrocyte sedimentation rate (ESR) = 83 mm/h), normal white blood cell count and normal creatine kinase level. Plain radiographs were normal, and there were no signs of thrombophlebitis at Doppler ultrasound. Magnetic resonance imaging (MRI) showed diffuse enlargement and an oedematous pattern of the adductors, vastus medialis, vastus intermedius and sartorius of the right thigh. The patient’s symptoms improved dramatically, making biopsy unnecessary, and a diagnosis of diabetic muscular infarction was reached. Idiopathic muscular infarction is a rare and specific complication of diabetes mellitus, typically presenting as a severely painful mass in a lower limb, with high ESR. The diabetes involved is generally poorly controlled longstanding Type 1 diabetes with established microangiopathy. Differential diagnoses include deep vein thrombosis, acute exertional compartment syndrome, muscle rupture, soft tissue abscess, haematoma, sarcoma, inflammatory or calcifying myositis and pyomyositis. In fact, physician awareness should allow early diagnosis on the basis of clinical presentation, routine laboratory tests and MRI, thereby avoiding biopsy and its potential complications as well as unnecessary investigations. Rest, symptomatic pain relief and adequate control of diabetes usually ensure progressive total recovery within a few weeks. Recurrences may occur in the same or contralateral limb.

Key-words: Diabetes, complication, skeletal muscle, muscle infarction.

RÉSUMÉ - Grosse cuisse douloureuse chez une diabétique: infarctus musculaire diabétique.
Une femme de 44 ans, avec un diabète de type 1 (mal contrôlé) depuis 5 ans a présenté un gonflement ferme, chaud et douloureux de la cuisse droite. La douleur était intense, sans fièvre ni notion de traumatisme ou d’effort anormal. La biologie retrouvait une acidocétose, une inflammation importante (VS 83 mm/h), un hémogramme et un taux de CPK normaux. Les radiographies étaient normales et le Doppler éliminait une phlébite. En IRM, il existait un net gonflement et un aspect oédématoux des muscles adducteurs, vaste médial, vaste intermédiaire et sartorius du membre droit. Une biopsie fut décidée, puis annulée devant l’amélioration spectaculaire du tableau, permettant le diagnostic d’infarctus musculaire. L’infarctus musculaire est une complication rare et spécifique du diabète sucré. Il se présente typiquement comme une masse très douloureuse d’un membre inférieur, dans un contexte inflammatoire. Il s’agit le plus souvent d’un diabète de type 1, généralement mal contrôlé et avec une microangiopathie patente, mais ce n’est pas toujours le cas. Les diagnostics différentiels sont les phlébites profondes, les syndromes de loge, les claquages musculaires, les abcès, hématomes, sarcomes des tissus mous, les myosites inflammatoires ou ossifiantes, et les pyomyosites. La connaissance de ce diagnostic, jointe à la présentation clinique, biologique et en IRM devrait permettre un diagnostic précoce et d’éviter le recours à la biopsie et ses complications potentielles ou à des examens inutiles. Le repos, le traitement antalgique et l’équilibration du diabète permettent la guérison en quelques semaines, avec de possibles récidives sur le même ou sur l’autre membre.

Mots-clés : Diabète, complication, muscle, infarctus musculaire.
The occurrence of a painful, inflammatory swelling in a lower limb is consistent with several diagnoses, such as deep vein thrombosis, compartment syndrome, muscle rupture, soft tissue infection, haemorrhagic or neoplastic processes, myositis, pyomyositis, etc. In the diabetic patient, an unusual diagnosis should be added to this list, i.e. so-called diabetic muscle infarction (DMI). Skeletal muscle infarction is a rare condition occurring specifically in the diabetic patient. Accurate management of DMI depends mainly on the physician’s awareness of this condition, which can avoid unnecessary or potentially hazardous investigations and delayed or inadequate treatment.

We report a case of DMI in a diabetic woman and a review of 43 previous cases in the literature.

**CASE REPORT**

**Clinical report** – A 44-year-old woman was hospitalised because of painful swelling of her right thigh. As her thinking was somewhat disturbed, the date of symptom onset remained uncertain. On the day of admission, she complained of continuous severe pain in the anterior right thigh and was unable to walk. The anteromedial distal part of her thigh was enlarged, diffusely firm, tender and warm, with an ill-defined oval mass in the vastus medialis and/or adductor muscles. The knee showed joint effusion but was otherwise normal and free of pain. There was moderate oedema of the left leg without signs of thrombophlebitis. The patient was thin but not febrile and denied any history of trauma or abnormal exercise. She had a history of Type 1 diabetes mellitus diagnosed 5 years earlier, which was poorly controlled because of a lack of compliance with follow-up and treatment.

**Admission laboratory tests** – showed fasting blood glucose (19 mmol/l) and moderate acidosis (pH 7.33, bicarbonates 18 mmol/l). The erythrocyte sedimentation rate (ESR) was 83 mm/h, with fibrinogen 6 g/l. Creatine kinase (CK) was “normal”, although at a higher level than later (83 IU/l versus 14 IU/l upon discharge from the hospital; normal range: 15-130). Blood cell count, creatinine and other routine parameters were normal.

**FIG. 1**. MRI of the thigh: muscles of the internal part of the mid-portion of the right thigh are enlarged and exhibit a normal signal on coronal TI-weighted spin echo sequences. Bone and subcutaneous tissues are normal.
Further investigations — showed glycosylated haemoglobin 16.7%, undetectable C-peptide level (<0.05 nmol/l) with positive anti-GAD antibodies (854 cpm), microalbuminuria (32 mg/24 h), non-proliferative retinopathy, and no other degenerative complications. Plain radiographs of the thigh and knee were normal. There were no signs of thrombophlebitis at Doppler ultrasound. Knee aspiration yielded a poorly cellular (<500 cells/mm³), translucent joint fluid. Radionuclide bone scan found only moderate increased uptake in soft tissues at the medial lower part of the thigh. Magnetic resonance imaging (MRI) of the thigh was performed using T1-weighted spin echo (T1 SE), gadolinium-enhanced T1 SE and T2 SE sequences in axial and coronal planes (Fig. 1, 2, 3 et 4). The results showed diffuse enlargement of the adductors, vastus medialis, vastus intermedius and sartorius of the right thigh (for which the signal was normal on T1 SE sequences, diffusely enhanced after gadolinium infusion and high on T2 SE sequences, with no subcutaneous or bony changes). Provisional diagnoses of pyomyositis, myositis or soft-tissue tumour were proposed, and an open biopsy was planned.

However, the patient’s symptoms improved spontaneously and dramatically within a few days, and the biopsy was cancelled. The diagnosis of diabetic muscular infarction was reached a posteriori. Within 4 weeks, pain and swelling completely disappeared in the thigh, the ipsilateral knee effusion and leg oedema cleared up, and ESR and fibrinogen returned to normal. CK level dropped to 14 IU/l. One year later, the patient had experienced no sequelae or recurrences.

DISCUSSION

Muscular necrosis is common following trauma, excessive exercise or prolonged compression (e.g. after poisoning). Conversely, idiopathic muscular infarction is rare and specific for diabetic patients. Only one case has been noted in the literature of idiopathic infarction of the psoas in a healthy, non-diabetic patient [1]. An extensive review of the literature found 43 cases of DMI [2-20], including those previously reviewed by Khoury et al. [2] plus those reported in 10 additional papers [3-12]. This entity was first described in 1965 by Angervall and Stener. Since then,
29 papers have appeared in the literature, including 22 in the 1990's, 10 of which were published in the last two years.

Typically, patients experience pain and swelling of a lower limb in the absence of any traumatism or abnormal exercise. The onset of symptoms may be abrupt or subacute, with a mean duration of 4 weeks until admission. The pain is intense and still present at rest, and the patient can hardly walk. Palpation reveals either a diffuse, warm, painful and firm swelling of a part of the limb, and/or an exquisitely tender oval mass usually less than 10 cm. The leg oedema and knee effusion observed in our case are uncommon, and may have been the result of impaired venous drainage secondary to considerable enlargement of the thigh muscles. Large muscles of the thigh are mainly involved, especially the quadriceps femoris and to a lesser extent the biceps femoris, the sartorius and the adductors, although calf muscles can also be affected [3, 9, 13-17]. It is noteworthy that neither fever nor skin redness occurs.

This condition usually affects patients with long-standing (mean duration = 16 years), poorly controlled Type 1 diabetes mellitus. Complications, i.e. nephropathy, retinopathy and/or neuropathy, are present in most patients at the time of presentation. However, DMI was reported in 7 non-Type 2 diabetic patients [2, 4, 5, 9, 10, 13], and was the first manifestation of Type 1 diabetes in one case [5]. In some cases, there was no associated diabetic complication [2, 5, 10, 13]. In our case, the patient had late-onset Type 1 diabetes of only 5 years' duration and mild retinopathy. DMI occurs slightly more often in women (F: M ratio = 1.4) at a mean age of 39.8 years (range: 25 – 65).

Laboratory tests consistently show major inflammation, with ESR equal to or greater than 100 mm/h in about half of cases. Blood cell count is usually normal, and CK level is either normal or slightly increased. In our patient, the initial CK level was in the normal range of values, but should be considered as too high in view of the low muscle mass of this thin patient and the low level of CK found subsequently after the infarct had improved. In any event, the reason for the low CK rise associated with such damage to large muscle(s) remains unclear, in comparison with the very high levels encountered in myocar-

![Fig. 3](image_url)

**Fig. 3.** On T2 SE sequences, adductors, sartorius and vastus medialis of the right thigh are swollen and exhibit a high signal. Effusion of the right knee can also be seen.
dial infarction or acute rhabdomyolysis. The reason could be the subacute nature of DMI or some delay between the onset of the infarction and the time of blood sampling. Plain radiographs are normal in most cases or may show some soft tissue swelling. Doppler ultrasound was performed for many of the reported cases, as well as for our patient, to rule out deep vein thrombosis when painful inflammatory swelling of the limb is involved. However, this examination was not informative about DMI itself. Radionuclide bone scan can show non-specific increased uptake in the muscles involved with necrosis, but is not useful for the diagnosis of DMI, and was performed mainly when a diagnosis of soft tissue tumour or infection with possible bone involvement was suspected. CT-scan performed in some cases was either normal [14, 17, 18] or showed enlargement of a muscle group whose density was normal or slightly decreased [2, 10, 13, 14, 19]. In fact, there is a consensus to designate MRI as the imaging method of choice for DMI diagnosis. The typical findings are diffuse muscle enlargement for which the signal is normal or slightly increased in SE T1 sequences, enhanced after magnetic contrast injection and high on SE T2 and/or fat-suppressed sequences, i.e. a diffuse oedematous pattern in one or several muscles [3-5, 7, 8, 16, 18-20]. Some oedema can also be present in subcutaneous and/or peri fascial spaces. There was no tumour-like mass or fluid collection, although DMI appeared in rare cases as a well-defined low-signal area surrounded by an inflammatory ring [9, 17]. In some cases, MRI also depicted concomitant similar changes in ipsi- or contralateral muscles, which appeared to be clinically normal [2, 3].

The usefulness and safety of needle or open biopsy is still controversial. Some authors have reported morbidity secondary to biopsy [14, 19], but most of the biopsied cases have shown no complications [3, 5, 9, 10, 15, 17, 18]. Differential diagnoses of DMI include deep vein thrombosis, which can easily be ruled out by Doppler ultrasound, acute exertional compartment syndrome and muscle rupture (however, CK level remains normal or increases only slightly in DMI, and the contexts are quite different), soft tissue abscess, haematoma, sarcoma, inflammatory or calcifying myositis and pyomyositis. Although non-specific, MRI findings easily rule out most of these conditions, so that the main difficulties are myositis and pyomyositis. Yet most authors consider that the conjunction of typical clinical signs of DMI in the absence of fever, skin redness and elevated blood cell count, together with suggestive MRI findings, are sufficient to ensure the diagnosis in a diabetic patient. Thus, needle or incisional biopsy should be performed only in questionable cases [2-5, 7, 19, 20]. When performed, the main histopathological finding is skeletal muscle fibre necrosis, often in conjunction with variable amounts of muscle regeneration, haemorrhage, oedema, interstitial fibrosis and mononuclear cell infiltration. Mi-

**FIG. 4** Axial T2-weighted images after gadolinium injection accurately show the location of the muscular oedematous pattern, which affects the adductors, vastus intermedialis, vastus medialis and sartorius.
croangiopathy and different coexisting stages of hae-
morrhagic necrosis are not uncommon.

Most authors consider that DMI results from dif-
fuse microangiopathy. Indeed, a majority of the repor-
ted cases had longstanding, poorly controlled diabetes
and the patients had already presented with retinopa-
thy, nephropathy and/or neuropathy at the time of
DMI. However, as noted above, this was not the
absolute rule.. Some authors have suggested throm-
boembolic events, but the rich collateral circulation
network for skeletal muscles makes this hypothesis
questionable, even though it has been suggested that
diffuse arteriosclerosis could change this to an end-
vessel circulatory pattern.

Conservative management with rest (bed rest
and/or avoidance of weight-bearing through use of
crutches), symptomatic pain relief (using analgesics
and/or non-steroidal anti-inflammatory drugs) and
adequate control of diabetes usually ensure progres-
sive total recovery within a few weeks. Excisional
biopsy and early deambulation or physical rehabilita-
tion have led to complications and delayed recovery
[14, 16]. Further recurrences of DMI in the same or
contralateral limb have occurred in more than one-
third of patients [2, 3, 5, 7, 9, 11, 14-16]. However,
this proportion is probably underestimated since many
reports failed to specify the long-term follow-up.

In conclusion, DMI is a rare complication of dia-
betes mellitus. Physician awareness should allow early
diagnosis on the basis of clinical presentation, routine
laboratory tests and MRI, thereby avoiding biopsy and
its potential complications as well as unnecessary in-
vestigations.

REFERENCES

1 Smellie WJ, Nelson JW, Eckersley JR, Bulstrode CJ. Idiopathic in-
farction of the psous with lumbar plexus involvement. J Bone Joint
Surg (Br), 1992, 74, 468-469.

2 Khoury NJ, El-Khoury GY, Kathol MH. MRI diagnosis of diabetic
muscle infarction: report of two cases. Skeletal Radiol, 1997, 26,
122-127.

3 Unpiereez GE, Stiles RG, Kleinhart J, Krengel DA, Watts NB.

4 Scully RE, Mark EJ, McNelly WK, Ebeling SH, Phillips LD. Case
records of the Massachusetts General Hospital. Weekly clinicopatho-

5 Damron TA, Levinsohn EM, M Quail TM, Cohen H, Stadnick M,
Rooney M. Idiopathic necrosis of skeletal muscle in patients who
have diabetes. Report of four cases and review of the literature. J.

6 Eady JL, Cobbs KF. Diabetic muscle infarction. J South Orthop
Assoc, 1997, 6, 250-255.

7 Keller DR, Erpelding M, Grist T. Diabetic muscular infarction. Pre-
venting morbidity by avoiding excisional biopsy. Arch Intern Med,
1997, 157, 1611-1612.


9 Bodner RA, Younger DS, Rosoklija G. Diabetic muscle infarction.

10 Becker BN, Otley CC, McNeill DB et al. Microangiopathic ischemic
myopathy of semimembranosus muscle in patient with diabetes mel-

11 Barton KL, Palmer BF. Bilateral infarction of the vastus lateralis
muscle in a diabetic patient: a case report and review of the literature.


13 Boluda B, Mesa J, Obiols G, Simo R. Focal muscle infarction in a

14 Chester CS, Banker BQ. Focal infarction of muscle in diabetics.
Diabetes Care, 1986, 9, 623-625.

15 Nunez-Hoyo M, Gardner CL, Motta AO, Ashmeal JW. Skeletal
muscle infarction in diabetics: MR findings. J Comput Assist Tomogr,
1993, 17, 986-988.

16 Van Slyke MA, Ostrow BE. MRI evaluation of diabetic muscle infar-

17 Vande Berg B, Malghem J, Puttemans T, Vandeleene B, Lagneau G,
Maldague B. Idiopathic muscular infarction in a diabetic patient.

18 Hinton A, Heinrich SD, Craver R. Idiopathic diabetic muscular in-
farction: the role of ultrasound, CT, MRI, and biopsy. Orthopaedic,

19 Chason DP, Fleckenstein J, Burns DK, Rojas G. Diabetic muscle

20 Kiers L. Diabetic muscle infarction: magnetic resonance imaging
(MRI) avoids the need for biopsy (letter). Muscle Nerve 1995, 18,
129-130.