Nontuberculous mycobacteria (NTM) are being increasingly recognized as causative pathogens of skin and soft tissue infections in both immunocompetent and immunocompromised patients. Since the diagnosis of skin and soft tissue NTM infections are usually readily made based on clinical presentations and histopathologic study, the ultrasound appearances of solitary subcutaneous NTM infection have never been presented in the past. Here we report such a case.

Key words: Nontuberculous mycobacteria; Skin, infection; Ultrasonography

CASE REPORT

A 42-year-old seafood vender working in a traditional marketplace visited the orthopedic out patient department on October 2, 2001 with the chief complaint of a growing painful mass over his right lower leg. Tracing back the history, he recalled having an abrasion wound on the same site about ten years ago after he had slipped and fell on the deck of a shrimp boat on which he had worked as a mechanic. Two years ago, he noticed a nodular eruption about the size of a grain of rice on his right lower leg, lateral to the upper shin. In the beginning, it was painless and freely movable with no discoloration or heat sensation. Within two years, it gradually grew into a firm fixed painful mass. No systemic symptoms such as general malaise, body weight loss, fever or chills were complained. He denied habitual smoking or drinking, major systemic diseases, major trauma, recent traveling or taking any medication. On physical examination, the mass appeared irregular in margin, tender and fixed, measuring about 5 cm in the maximal diameter. No local heat, skin ulceration or discoloration was noted. No other abnormal findings were found during the physical check up. The laboratory studies including complete blood cell count, differential white count, C-reactive protein, erythrocyte sedimentation rate, liver and renal profiles all were within normal limits. Serial imaging work up was done and the plain films of his right lower leg showed focal soft tissue swelling and cortical thickening of the anterior tibia. Plain chest film disclosed clear lung fields with no mediastinal or hilar adenopathy. Ultrasound examination was performed using a GE LOGIQ 700MR scanner with a M12L, 13 MHz transducer (GE, Milwaukee, WI, USA). An ill-defined infiltrative hypoechoic lesion in the subcutaneous layer of the anterior tibial region was shown on gray scale sonogram. On color Doppler ultrasonography, the lesion appeared hypervascular. Under the impression
of possible soft tissue neoplasm, ultrasound guided core biopsy of the mass was carried out on October 8, 2001 for histopathologic diagnosis. Chronic inflammation with granulation tissue was reported initially. On October 19, 2001, the mass was removed by excisional biopsy. Positive acid-fast bacilli were found in the specimen. Therefore, he started chemotherapeutic therapy (Ethambutol, Rifampin and Clarithromycin) since October 20, 2001. Six weeks later, the mycobacterial culture reported atypical tuberculosis and the patient continued with his medical treatment. In the following months, however, several times of debridement had to be performed due to poor wound healing. Despite repeated ordinary mycobacterial culture with each debridement, isolation of the causative pathogen had failed. After nearly eighteen months of chemotherapeutic therapy, the wound was still poorly healed, leaving a small ulceration with intermittent discharge.

**DISCUSSION**

Formerly called atypical tuberculosis, the nontuberculous mycobacteria (NTM) encompass all mycobacterial species other than *Mycobacterium tuberculosis* complex. Ubiquitous in the environment, particularly in the water, NTM are facultative human pathogens. Over 50 species of NTM have been recognized and only a few are important pathogens in both the immunocompetent and immunocompromised [1]. Being increasingly recognized, NTM seems to be more frequently the causes of mycobacterial skin diseases instead of *M. tuberculosis* [2].

Through direct exposure to contaminated water sources following accidental trauma, surgery, percutaneous catheterization, injection, etc, NTM inoculate and develop skin and soft tissue infections in immunocompetent patients [1]. The rapid-growing species such as *M. fortuitum*, *M. abscessus* and *M. chelonae* have been reported to cause localized abscess formation in nosocomial skin and soft tissue infections [3]. These three, altogether with slow-growing species such *M. marinum*, *M. avium* complex and *M. kansasii*, can cause chronic granulomatous infections of the tendon sheaths, bursa, joints and bones [4]. Infection with *M. ulcerans* can appear as painless enlarging subcutaneous nodule, which eventually ulcerates [5]. Rarely, *M. haemophilum*, *M. nonchromogenicum* and *M. smegmatis* have been identified in localized skin and soft tissue diseases [1]. Apart from localized skin and soft tissue disease related to penetrating injury, skin and soft tissue involvement associated with disseminated NTM disease may occur.

In our patient, the mass lesion on his lower leg appeared as an ill-defined infiltrative heterogeneously hypoechoic area, confined to the thickened subcutaneous tissue on gray scale ultrasound examination. The anterior tibialis muscle underneath was sonographically intact. (Fig. 1a, 1b) On color Doppler and spectral Doppler studies, hypervascularity and arterial flow pattern with low resistance (resistive index = 0.66) were demonstrated, respectively. (Fig. 2 and 3) Such ill-defined infiltrative hypoechoic subcutaneous lesions have been described in edema caused by various pathologies including cellulitis, panniculitis, venous insufficiency, lymphedema, subcutaneous hemorrhage, ruptured Baker's cyst [6, 7], diffuse form of neurofibroma in neurofibromatosis type 1 [8, 9],

**Figure 1.** a. Longitudinal scan of the mass lesion at pre-tibial region of right lower leg showed an ill-defined infiltrative heterogeneously hypoechoic area (arrows), confined to the thickened subcutaneous tissue. The underlying anterior tibialis (arrowheads) muscle is intact. b. Axial scan of the mass lesion is shown (arrows). T: tibia.
and lymphoma [7, 9]. In edema, the subcutaneous tissues appear thickened with an inversion of the normal appearance— the fibrous septae become hypoechoic, and the surrounded fat hyperechoic (Fig. 4). On Doppler study, increased flow signal often can be found in the hypoechoic septae. Diffuse form neurofibromas are typically localized in the subcutaneous tissues and result in marked subcutaneous thickening. They appear as ill-defined hypoechoic areas, which extensively reticulate through the subcutaneous tissues, with absent or sparse flow signal on Doppler study [8, 9]. Appearing as ill-defined infiltrative hypoechoic areas in the thickened subcutaneous tissue and often the dermis, lymphoma, on the other hand, characteristically demonstrates intense flow signal on Doppler study [7, 9] (Fig. 5).

Although the causative NTM was not successfully isolated, we try to propose the possible causative pathogen based on our patient’s clinical setting. The long-standing and indolent clinical course in our case speaks against infections with fast growing NTM, namely *M. fortuitum*, *M. abscessus* and *M. chelonae*, which are more virulent and usually lead to ulceration and rupture within weeks to months after inoculation [10]. Among the more common organisms of slow-growing NTM related to localized skin and soft tissue diseases, *M. marinum* seems to have strong association with our patient’s distinct clinical picture. The reasons are discussed as follows. First, *M. marinum* is prevalent in the warm water, both fresh and salty. Infection with *M. marinum* is usually acquired through

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**Figure 2.** Color Doppler sonogram shows increased vascular flow.

**Figure 3.** Spectral Doppler sonogram shows arterial flow pattern with resistive index of 0.66.

**Figure 4.** Cellulitis. Longitudinal scan of the subcutaneous layer of lateral aspect of right thigh of a 48-year-old diabetic woman is shown. The subcutaneous layer is thickened. The hyperechoic fatty tissues are surrounded by hypoechoic fibrous septae (small arrows). Deep to the subcutaneous layer, emphysematous abscess formation dissecting among the adductus muscles (not shown) was confirmed by percutaneous aspiration.

**Figure 5.** Lymphoma. Power Doppler sonogram of the medial aspect of right knee of a 72-year-old man is shown. Ill-defined hypoechoic areas (arrows) with markedly increased flow signal infiltrate in the thickened subcutaneous layer. Core biopsy was performed targeted at the hypervascular hypoechoic area and large B cell lymphoma was confirmed.
contamination of minor skin abrasions during cleaning fish tanks, handling fish, swimming or doing other aquatic activities [11]. As a seafood vendor in the marketplace, our patient had to constantly handle all kinds of marine fish, which makes it understandable that minor abrasion to his right lower leg had occurred during his daily work and had lead to direct inoculation of *M. marinum*. Second, *M. marinum* infection usually begins as a slow growing solitary nodule or papule on the extremity, which involves the skin or subcutaneous tissue without regional lymph node enlargement [12], as we have seen in our patient. Deeper invasion to the bone, joint or tendon sometimes may occur. Occasionally, multiple or disseminated diseases can develop, especially in the immunocompromised [13]. Third, in 70-90% of infections, *M. marinum* grows in 7-10 days on ordinary mycobacterial culture medium at 30-33°C while significant growth inhibition occurs at 37°C, the adapted temperature for routine mycobacterial culture. This may explain the initial frustrating culture yield we experienced since none of obtained specimen was requested to culture at 30-33°C. Lastly, in vitro susceptibility results in the study by Alexandra Aubry, et al. have shown that *M. marinum* possesses a natural multidrug resistance pattern, which explains both cure and failure being described in the various drugs used, including cyclines, rifampin plus ethambutol, clarithromycin, levofloxacine, amikacin, and sparfloxacin [13]. They have pointed out that the optimal regimen of chemotherapeutic therapy has not been established and the benefit of surgical intervention has remained unclear. These facts may answer the unsatisfactory therapeutic outcome our patient had experienced.

As skin infections caused by NTM increases in the past decade, it is deemed an emerging infection [14]. Challenging as it may be, we ought to be familiarized with the diverse manifestations of skin and soft tissue NTM infections both clinically and sonographically.

**REFERENCES**

獨發性非結核分枝桿菌皮下感染的超音波表現

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非結核分枝桿菌所造成的皮膚及軟組織感染，無論在免疫健全或免疫不全者均已越來越常見，此類疾病通常由臨床表現及組織病理學檢查即可確立診斷，但其影像學之發現至今仍罕被提及。在此我們報告其超音波表現，以提供為輔助診斷之用。

關鍵詞：非結核分枝桿菌，皮膚，超音波檢查