CASE REPORT

Management of Multiple Miliary Osteoma Cutis Using CO_2 Laser: A Case-Based Exploration

by MIGUEL A. ARISTIZABAL-TORRES, MD; MISTY M. HOBBS, MD; THAIS PINCELLI, MD; OLAYEMI SOKUMBI, MD; and ALISON J. BRUCE; MB, ChB

Drs. Aristizabal-Torres, Hobbs, Pincelli, Sokumbi, and Bruce are with the Department of Dermatology at Mayo Clinic Florida in Jacksonville, Florida. Dr. Sokumbi is additionally with the Department of Laboratory Medicine & Pathology at Mayo Clinic Florida in Jacksonville, Florida.

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Miliary osteoma cutis is an underreported condition that typically presents with firm papules on the face, although involvement of other areas has been described. It commonly presents in middle-aged women with fair skin. Treatment options for this condition are limited. We describe two patients with miliary osteoma cutis, detailing the treatment strategies used, including the successful use of carbon dioxide laser-assisted extraction. **KEYWORDS:** Osteoma cutis, miliary osteoma cutis, CO_2 laser, facial papules

In 1858, Wilckens[1] first described heterotopic bone formation within the dermis as osteoma cutis. This concept was further refined by Virchow[2] in 1864, when he characterized it as multiple miliary lesions affecting various anatomical areas. Multiple miliary osteoma cutis (MMOC) is a rare condition, often underreported or overlooked in the literature. It most commonly presents in middle-aged women with fair skin. Interestingly, it has also been incidentally detected during dental radiologic studies in 2.2% to 27% of diverse population subsets, although conditions with similar radiologic findings, such as calcinosis cutis, could have been included in these studies.[3,4]

MMOC is classified as primary in 15% to 20% of cases when no underlying cause is identified.[5] Secondary MMOC accounts for 80% to 85% of cases and is associated with preexisting conditions, such as acne, connective tissue disease, hereditary disorders, and trauma.[6] Unlike other hereditary conditions that present with dystrophic calcification, MMOC has not been associated with any specific genetic mutations.[7] Clinically, it commonly presents with asymptomatic papules on the face in women, while men tend to present with lesions involving extrafacial areas such as the neck or trunk.[6,8]

Lesions of MMOC are typically asymptomatic, often resulting in misdiagnosis and delayed diagnosis. However, patients may express concerns due to the cosmetic implications of lesions. Treatment options for MMOC are limited. In this report, we discuss two cases of MMOC, including the use of a carbon dioxide (CO_2) laser-assisted approach as part of the management strategy.

CASE REPORTS

Patient 1. A 42-year-old woman presented to the dermatology department with asymptomatic papules on her face for more than 7 years. She had not sought evaluation earlier, attributing these lesions to acne scarring. Her past medical history was notable for recurrent *BRCA1*-positive breast cancer, with metastasis to the lymph nodes, for which she underwent bilateral mastectomy, axillary lymph node dissection, and chemoradiotherapy. Additionally, she reported a history of severe acne involving the forehead, cheeks, and chin during adolescence and early adulthood, which was effectively treated with spironolactone. After resolution of her acne, she noticed a gradual development of facial papules, which eventually stabilized. Physical examination revealed numerous skin-colored 1 to 3 mm smooth, firm papules on the forehead and cheeks (Figure 1). Her Fitzpatrick skin phototype was determined to be Phototype II. Dermoscopic findings were nonspecific; however, upon close examination, subtle whitish material was visualized in the superficial papules. A 3-mm punch skin biopsy was obtained from her right buccal cheek, demonstrating dense eosinophilic deposits in the superficial-to-mid dermis consistent with mature bone and compatible with osteoma cutis (Figure 2). Laboratory evaluation for secondary causes of MMOC, including serum calcium, phosphorus, parathyroid hormone, vitamin D, alkaline phosphatase, lactate dehydrogenase, creatinine kinase, antinuclear antibody (ANA), extractable nuclear antigen (ENA), and anticentromere antibody, was negative for disorders of calcium metabolism or connective tissue disease.

Prior to biopsy, the patient was treated empirically with oral doxycycline 100 mg twice a day, topical metronidazole cream 0.75%, and azelaic acid gel 15% without improvement. Following biopsy, she completed a 4-month course of tazarotene 0.1% cream nightly with no response. Manual extraction attempts using a sterile #11 blade, following infiltration with 1% lidocaine with 1:100,000 epinephrine, yielded bony fragments. Electrodesiccation was also attempted but proved to be inferior to blade extraction. To reduce the risk of scarring, laser-assisted extraction was performed using a CO_2 laser (Candela CO2RE) in continuous mode with a surgical handpiece, a spot size of 1 mm, and a fluence of 10 J. The laser treatment created precise entry points that allowed for manual extraction

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CORRESPONDENCE: Miguel Aristizabal-Torres, MD; Email: aristizabal.miguel@mayo.edu

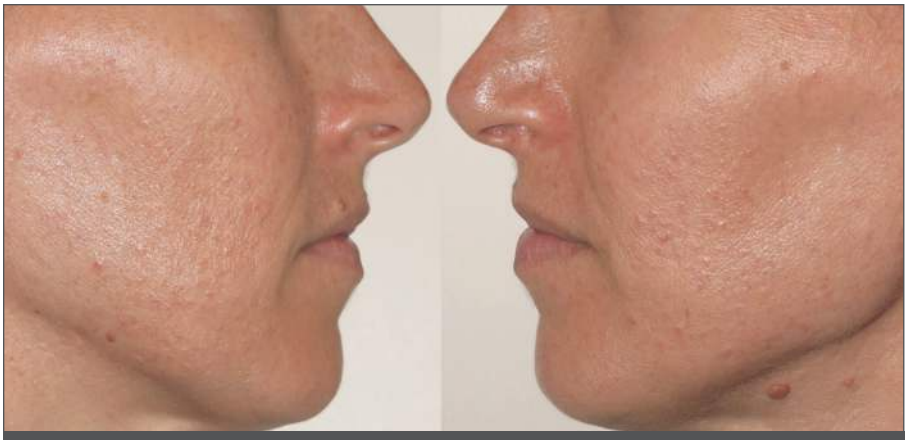

FIGURE 1. Multiple miliary osteoma cutis papules on the bilateral cheeks

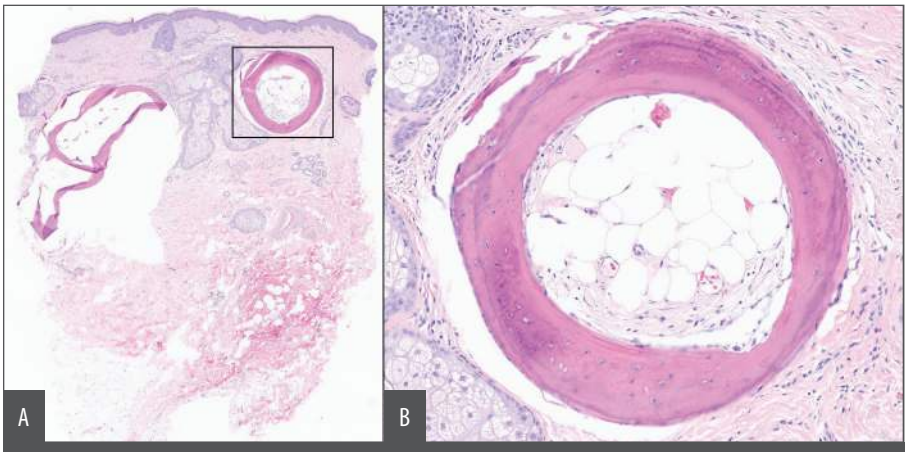

FIGURE 2. Histopathology of a representative lesion demonstrating dense eosinophilic deposits in the dermis with characteristic osteocytes within small lacunae. Mature fat recapitulating marrow identified in the center (hematoxylin and eosin; [A] ×3.0 original magnification; [B] ×20 original magnification)

FIGURE 3. Patient immediately posttreatment

using an 18-gauge needle or a sterile #11 blade. Lesions were found to be firmly attached to the dermis and underlying subcutaneous tissue (Figure 3 and Figure 4). Several lesions were extracted successfully, with adequate patient tolerability and no evidence of noticeable scarring. The patient reported high satisfaction with the treatment strategy employed (Figure 5).

Patient 2. A 65-year-old woman presented to the cosmetic center of our dermatology department with concerns of facial papules that had increased in number for the past 3 years. Her medical history was notable for sarcoidosis, uveitis, and inflammatory arthritis, for which she was receiving treatment with prednisone, methotrexate, and adalimumab. Physical examination revealed scattered skin-colored, smooth, firm, discrete 1mm to 2mm papules involving the bilateral cheeks and chin (Figure 6). Her Fitzpatrick skin phototype was determined to be Phototype IV. Given the clinical morphology of the lesions and the patient's medical history, cutaneous sarcoidosis was initially considered as the primary differential diagnosis. However, a skin biopsy obtained from the preauricular area revealed osteoma cutis (Figure 7). Laboratory evaluation, including serum calcium, phosphorus, parathyroid hormone, vitamin D, alkaline phosphatase, lactate dehydrogenase, creatinine kinase, ANA, ENA, and anticentromere antibody, was unremarkable. Considering her medical history, skin type, and reported history of poor wound healing and scarring, both laser resurfacing and laser-assisted extraction were deferred. She was started on tazarotene 0.1% cream at bedtime, targeting transepidermal elimination; the assessment of her response to the treatment is forthcoming. The patient continues to be monitored by both the rheumatology and dermatology departments.

DISCUSSION

Due to the increased likelihood of clinical misdiagnosis, the prevalence of MMOC may be underestimated.[9,10] This neglected condition not only raises cosmetic concerns for patients but also presents challenges in treatment. One clinical mimicker of MMOC is miliary calcinosis cutis (MCC).[11] Distinguishing between the two entities is crucial because both have been regarded as secondary to other clinical conditions, such as systemic sclerosis and dermatomyositis for MMOC, and renal failure and myeloma for MCC, among others.[12] On histopathology, MCC presents with calcium salt deposits localized in the dermal-subcutaneous tissue junction in MCC, while MMOC is characterized by bone fragments in the mid-dermis.[12]

The etiology of MMOC has been attributed to intramembranous ossification occurring in specific areas within the dermis.[13,14] In the literature, it is often described as a presumptive metaplastic response to preexisting conditions,

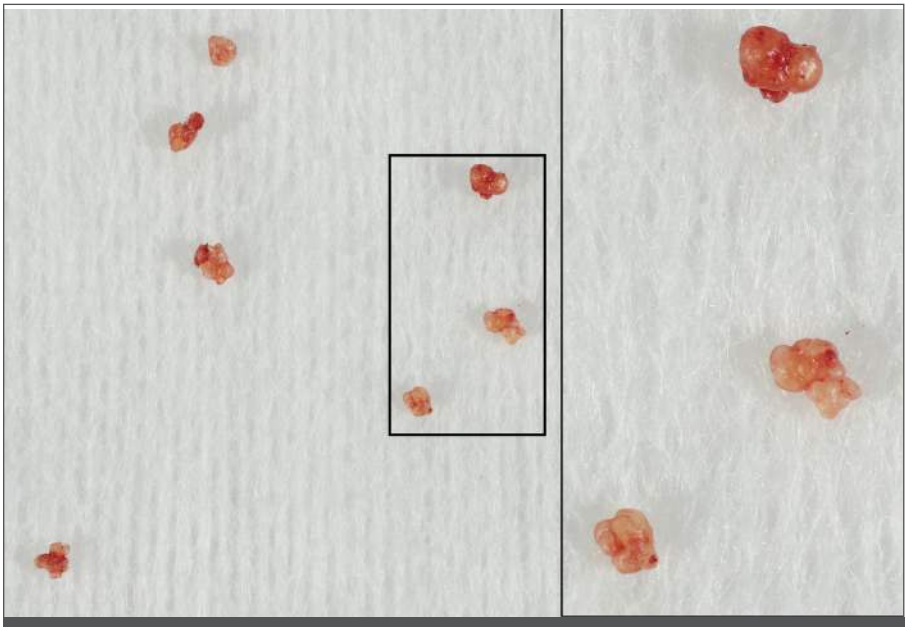

FIGURE 4. Extracted multiple miliary osteoma cutis lesions; close up examination, highlighting the lobulated appearance of the extracted lesions

FIGURE 5. Patient at the 6-month follow-up postprocedure

FIGURE 6. (A) Multiple miliary osteoma cutis papules; (B) close-up examination

typically of an inflammatory nature. This process involves the activation of resident mesenchymal multipotent cells, which are influenced by bone-related cytokines, leading them to follow an osteoblast-like pathway.[15] Recognizing the female preponderance of MMOC, estrogens have been implicated in disease pathogenesis.[7] However, controversy exists, as cases in men and postmenopausal women have also been reported.[16] Recently, *Cutibacterium acnes* deoxyribonucleic acid (DNA) has been identified within MMOC lesions, raising concerns for a possible pathogenic association.[17]

Clinically, MMOC is characterized by 0.5- to 3-mm papules, most commonly manifesting on the face.[18,19] These papules may exhibit a whitish hue, though pigmented variants have also been described.[20] Diagnostic confirmation is achieved through histopathologic examination, which demonstrates bone spicules of different dimensions located within the dermis or subcutaneous tissue.[21,22] These bone formations contain numerous osteocytes and are marked by cement lines, which may appear more prominent under polarized light. Moreover, osteoblasts are commonly observed along the surface of the spicules, with osteoclasts often found in Howship's lacunae.[23] In cases where additional clinical findings suggest hereditary conditions or other secondary causes, serum calcium and parathyroid hormone levels can aid in excluding such conditions.[6,24] Additional imaging studies can also be employed to assess the extent of the disease.[25]

Treatment options for MMOC are limited. Initially, bisphosphonates were employed with the goal of reducing bone remodeling, with poor success.[26] Topical retinoids are an adequate initial therapy, especially for superficial lesions or those with a diameter of 1 mm or less.[27,28] However, escalation of therapy is often necessary, for example, using dermabrasion with punch biopsy,[29] scalpel incisions and curettage,[30] or needle-assisted extraction.[9,31,32] Erbium:yttriumaluminum-garnet (YAG) laser,[33] Nd:YAG laser,[8] and CO_2 laser[34] have also been described as treatment alternatives.

Our previous experience performing CO_2 laser-assisted extraction in the treatment of MCC inspired us to adopt a similar strategy for MMOC.[35] Both conditions required manual extraction; however, MMOC lesions were morphologically different, exhibiting a lobulated aspect and a notably firmer attachment to the dermis than MCC. Postlaser care is crucial to minimize the risks of scarring and pigmentary changes. While laser-assisted extraction may offer beneficial results, clinicians should remain cautious of the potential risks associated with any laser-assisted or extraction technique.

CONCLUSION

MMOC is an often underrecognized condition that requires histopathologic confirmation with implications for diagnosis and treatment. Our case reports underscore the importance of considering MMOC in patients presenting with firm, asymptomatic facial papules. MMOC can significantly impact quality of life due to cosmetic concerns. Treatment options are limited and often involve manual extraction, which can be laser-assisted. Clinicians should remain vigilant for potential complications associated with treatment.

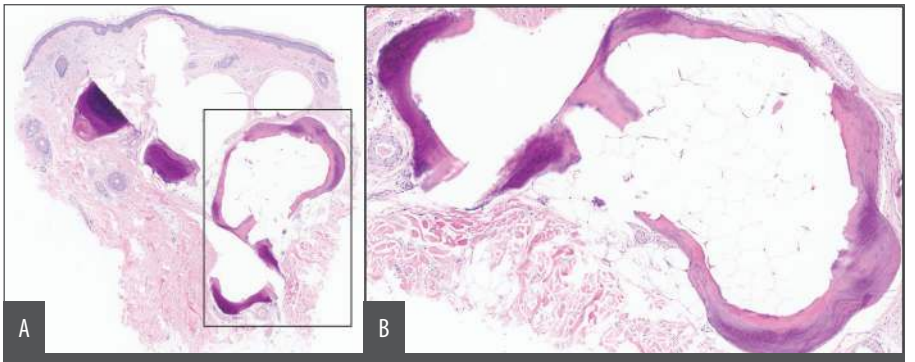

FIGURE 7. Histopathology of a representative lesion demonstrating clusters of osteoid formation in the absence of an inflammatory response (hematoxylin and eosin; [A] ×4.0 original magnification; [B] ×13 original magnification)

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