ORIGINAL ARTICLES

Microcystic Adnexal Carcinoma: Mohs Micrographic Surgery as the Treatment of Choice

A. Martorell-Calatayud,ª C. Requena-Caballero,ª R. Botella-Estrada,ª S. Almenar-Medina,ᵇ O. Sanmartín-Jiménez,ª B. Llombart-Cussac,ª E. Nagore-Enguídanos,ª C. Serra-Guillén,ª B. Echeverría-García,ª and C. Guillén-Baronaª

ªServicio de Dermatología, ᵇServicio de Anatomía Patológica, Instituto Valenciano de Oncología, Valencia, Spain

Abstract. *Introduction and objectives.* Microcystic adnexal carcinoma is a rare and aggressive tumor that manifests clinically as a subcutaneous nodule located on the head or neck. The tumor can be confused clinically and histologically with other benign and malignant skin lesions, often leading to inappropriate initial treatment. The chief concern with microcystic adnexal carcinoma is the elevated morbidity and the high rate of recurrence after wide local excision. Recent preliminary studies point to higher cure rates with Mohs micrographic surgery.

Material and methods. We reviewed the medical histories of 6 consecutive patients with microcystic adnexal carcinoma who underwent Mohs micrographic surgery in our dermatology department between 1995 and 2007.

Results. In all cases, lesions were located on the head and were primary tumors. Seventy percent of the tumors were wrongly diagnosed initially as basal cell carcinoma. Perineural invasion was not detected in any patient, and all were free of recurrence after between 1 and 12 years of postoperative follow-up.

Conclusions. The absence of perineural involvement and substantial cell atypia can be attributed to the lesions being primary tumors. This would provide a rationale for definitive radical treatment of the primary tumor from the outset to avoid the complications associated with recurrence. The site and the absence of recurrence in all our patients who underwent Mohs micrographic surgery support the use of this technique as the treatment of choice in microcystic adnexal carcinoma.

Key words: microcystic adnexal carcinoma, Mohs surgery, perineural invasion.

CARCINOMA ANEXIAL MICROQUÍSTICO: LA CIRUGÍA MICROGRÁFICA DE MOHS COMO TRATAMIENTO DE ELECCIÓN

Resumen Introducción y objetivos. El carcinoma anexial microquístico (CAM) es un tumor raro y agresivo que clínicamente se manifiesta como un nódulo subcutáneo localizado en las regiones de cabeza y cuello. Esta tumoración puede ser clínica e histológicamente confundida con otras lesiones cutáneas benignas o malignas, loque con frecuencia conduce a un tratamiento inicial erróneo. La principal complicación del CAM es la alta morbilidad y la elevada tasa de recurrencia tras escisión local amplia. Estudios preliminares recientes han mostrado unas mayores tasas de curación mediante cirugía micrográfica de Mohs (CMM).

Material y métodos. Se revisaron las historias clínicas de 6 pacientes consecutivos con CAM tratados mediante CMM en nuestro Servicio de Dermatología entre 1995 y 2007.

Resultados. Todos los casos se localizaron en la cabeza y el 100 % fue tumor primario. En el 70 % de los casos el tumor fue inicialmente mal diagnosticado de carcinoma basocelular. No se detectó invasión perineural en ninguno de los casos y la recurrencia estuvo ausente en todos los pacientes tras un periodo de seguimiento comprendido entre 1 y 12 años posteriores a la CMM.

Conclusiones. La ausencia de afectación perineural y de una importante atipia celular puede deberse al carácter primario de la tumoración. Ello justificaría la necesidad de un tratamiento definitivo radical inicial del tumor primario para evitar las complicaciones que implica una recidiva tumoral. La localización y la ausencia de recurrencia en todos nuestros casos tratados mediante CMM apoyan el uso de esta técnica como el tratamiento de elección para el CAM.

Palabras clave: carcinoma anexial microquístico, cirugía de Mohs, invasión perineural. .

Correspondence:
Antonio Martorell Calatayud.
C/ San José de la Montaña, 14, puerta 11
46008 Valencia, Spain
antmarto@hotmail.com

Introduction

Microcystic adnexal carcinoma (syringomatous carcinoma, malignant syringoma, desmoplastic carcinoma of the sweat glands)[1-3] is an uncommon skin tumor with 2 different types—glandular and follicular. It was first described by Goldstein et al[4] in 1982.

It is characterized by its aggressive local nature, high infiltrating capacity, and marked neurotropism, all of which explain the high recurrence rate, despite administration of aggressive treatment.

There is currently some controversy over the best therapeutic option for complete eradication of microcystic adnexal carcinoma. The therapeutic and aesthetic advantages of Mohs micrographic surgery (MMS) could make it a treatment of choice for this tumor. However, experience with this technique in adnexal tumors is very limited.

We report a series of 6 cases of microcystic adnexal carcinoma treated using MMS in a single dermatology center. We analyze the various clinical and surgical parameters of the patients, as well as recurrence during long-term follow-up.

Material and Methods

We reviewed the medical and surgical history of 6 patients diagnosed at the dermatology department of the Instituto Valenciano de Oncología, Valencia, Spain, between 1995 and 2007. In each case, the histopathological diagnosis was confirmed by a pathologist using hematoxylin-eosin-stained biopsies.

The specimens were obtained and processed following the Mohs micrographic technique with 0.5-cm stages until there was no further involvement of the surgical margins. The technique was performed on paraffin-embedded specimens in 4 cases and on fresh frozen specimens in the other 2. In the fresh specimens, an additional stage was excised once the disease-free margins were reached.

For each patient we collected the following data: age, gender, site, time since onset, exposure to ionizing radiation, primary or recurrent lesion, size of the lesion in the preoperative clinical examination, number of MMS stages necessary to reach the disease-free margins, size of the postsurgical defect, follow-up period, and recurrence during follow-up.

After a PubMed search of the literature, we reviewed all cases of microcystic adnexal carcinoma treated using MMS between 1982 and 2007. From those reports, we recorded the following parameters: number of cases of microcystic adnexal carcinoma treated (divided into primary and recurrent cases), percentage of recurrences, mean number of surgical stages performed, and mean follow-up of patients treated.

Results

Table 1 shows the different clinical-surgical parameters of the 6 patients (5 women and 1 man, aged between 38 and 90 years [mean, 69 years]). All the tumors analyzed were primary tumors; none of the patients had previously undergone radiotherapy at the site of the lesion. Three of the cases had previously presented one or more basal cell carcinomas on the face. The tumor was on the face in all patients (3 on the cheek, 2 on the nasolabial crease, and 1 on the chin), and was right-sided in 4. The size of the lesion ranged between 0.5 cm × 0.6 cm and 2.0 cm × 2.0 cm.

The mean number of stages required to reach the disease-free margins was 1.4, and the size of the resulting surgical defect ranged between 1 cm × 1 cm and 4 cm × 3 cm.

All the patients underwent additional tests, including laboratory work-up (complete blood count, liver and renal function tests, and coagulation studies) and chest radiograph, all with normal results.

Follow-up varied between 1 year and 12 years (mean, 5 years). There were no recurrences.

Discussion

Microcystic adnexal carcinoma is a malignant adnexal tumor that appears most commonly in women aged 50 to 69 years.[3,5-10] White and Asian individuals are more predisposed to the development of this tumor,[11] and few cases have been described in African American patients.[2,6,12,13]

There seem to be several risk factors, including exposure to ultraviolet and/or ionizing radiation and underlying immunosuppression.[3]

Microcystic adnexal carcinoma takes the form of a stony-hard pseudocyst, plaque, or nodule. It is asymptomatic, grows slowly and progressively, and has a mean diameter of 2 cm at the time of diagnosis (Figure 1).[14] The presence of soreness, paresthesia, or pain at the site of the tumor points to possible perineural involvement, which varies from 18% to 59% with this tumor.[14]

Microcystic adnexal carcinoma is found on the head and neck in up to 83% of cases.[11,15] Seventy-three percent of these cases are found on the face, mainly in the area of the eyelid[16,17] and the nasolabial crease.

The mean delay between onset of the lesion and the histopathological diagnosis varies with gender. Thus, whereas mean diagnostic delay is 1 year in women, in men it can reach as much as 5 years.[11] We found this delay to range from 6 months to 14 years; however, no relation with gender could be established, as the study population comprised mostly women.

Table 1. Characteristics of Patients Treated With Mohs Surgery in Our Department

Age/Sex	Course, y	Presenting Complaint	Previous Skin Cancer	Site	Physical Examination	Suspected Diagnosis	No. of Stages (Surgical Defect)	Follow-up, y/ Recurrence
69/Man	2	Asymptomatic plaque	No	Left cheek	Stony-hard, yellowish poorly delimited plaque measuring 1 × 1.5 cm	Adnexal tumor	2 (7 × 2 cm)	3/No
61/Woman	14	Asymptomatic indurated plaque	No	Right chin	Stony-hard plaque with a central depression measuring 2 × 2 cm	Adnexal tumor	2 (5 × 5 cm)	2/No
61/Woman	1	Indurated yellow plaque	BCC	Right nasolabial crease	Ivory-colored papule with telangiectasia measuring 1 × 1 cm	BCC	2 (3 × 3 cm)	1/No
52/Woman	3	Scarring	No	Right cheek	Yellowish papule measuring 2 × 1 cm	BCC	1 (3 × 3 cm)	1/No
81/Woman	1	Semihard nodule	BCC	Left cheek	Yellowish indurated papule measuring 0.5 × 0.6 cm	CBC	1 (1.5 × 1.5 cm)	12/No
48/Woman	11	Indurated yellowish nodule	BCC	Right nasal ala	Indurated papule measuring 1 × 1 cm	BCC	2 (2 × 2 cm)	9/No

Abbreviation: BCC, basal cell carcinoma

Microcystic adnexal carcinoma can penetrate deeper planes,[18] and it frequently invades the subcutaneous tissue and underlying skeletal muscle. There have been reports of involvement of the perichondrium, periosteum, adventitia of the blood vessels, and even bone.[19] Histologically, the tumor is characterized by sparing of the epidermis and occupation of the superficial reticular and papillary dermis by small cysts with keratinization of the isthmus and follicular infundibulum (Figure 2). In the middle and deep reticular dermis, the existence of multiple islets of basal cells is noteworthy. These cells show intracytoplasmic vacuolization and, in certain areas, they form ducts with well-defined lumens covered by flattened cells organized into 1 or 2 layers (Figure 3).[20,21]

Perineural infiltration, which has been described in less than 5% of tumors of the head and neck,[22-24] is a relatively frequent phenomenon in microcystic adnexal carcinoma, and has been detected after histopathology study in between 17.5%[23] and 59% of patients depending on the series.[25] This phenomenon appears mainly in

Figure 1. Poorly delimited ivory-colored plaque with telangiectasia on the right cheek.

recurrence of adnexal carcinoma (up to 87.5% of cases),[18] and is uncommon in primary adnexal carcinoma; hence the importance of optimal initial therapy as a means of
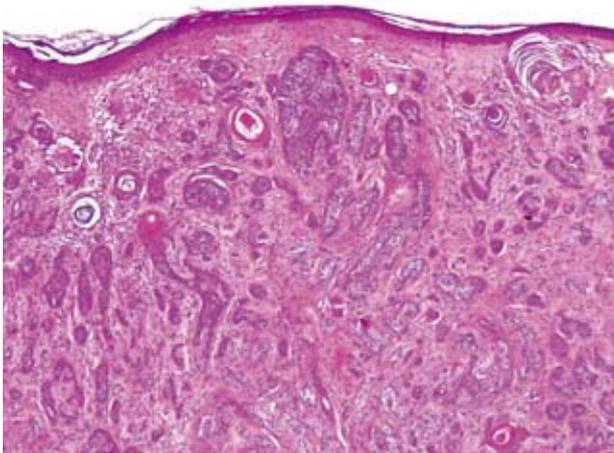
Figure 2. Epithelial islands and some horny cysts in the superficial dermis (hematoxylin-eosin, ×20).

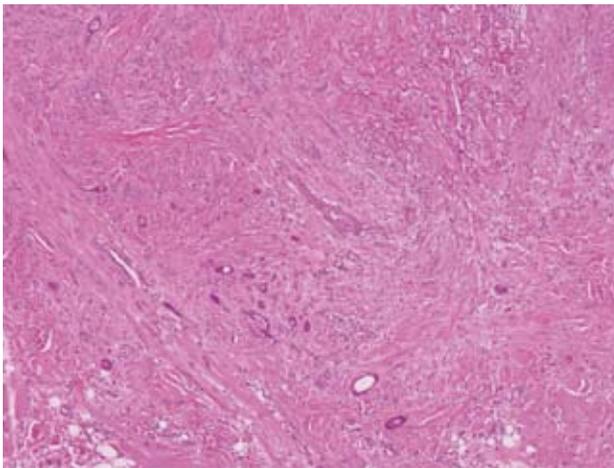**Figure 3.** The mid-dermis has been invaded by small epithelial islands. Tubular structures can be seen in the deep dermis (hematoxylin-eosin, ×20).

reducing the overall percentage of these tumors with perineural infiltration. None of our cases had perineural infiltration, possibly because all the tumors treated in our series were primary tumors.

Microcystic adnexal carcinoma is difficult to diagnose both from a clinical and from a histologic viewpoint.[26] In fact, depending on the series, between 25% and 53% of cases were incorrectly diagnosed clinically, with the most common initial diagnosis being sclerodermiform basal cell carcinoma.[5,11] In many cases, the difficulty of the clinical diagnosis is compounded by errors in the histopathologic diagnosis, because shave biopsy specimens do not allow the characteristic stratified pattern of microcystic adnexal carcinoma to be analyzed.[27] In our study, 4 of the 6 cases were clinically diagnosed with basal cell carcinoma, and in 1 of these the histopathology

results supported this diagnosis. However, in this case, shave biopsy was performed, and the subsequent punch biopsy confirmed the diagnosis of microcystic adnexal carcinoma. Thus, in a sclerodermiform lesion in an exposed area, a tissue sample reaching the subcutaneous layer must be obtained.

The main problem with microcystic adnexal carcinoma is its locally aggressive behavior, which is seen in its marked invasive capacity and high frequency of perineural involvement,[28] leading to a high frequency of local recurrence after conventional excision, reaching 40% to 60%.[5,28,29] Distant spread is very rare; only 5 cases of locoregional lymph node spread have been reported, 4 on the same side as the tumor[30] and 1 contralateral.[32] Furthermore, systemic involvement is exceptional, with isolated cases in the lung,[32] bone,[29] and liver.[33]

The available therapeutic options for this tumor include radiotherapy and surgery, both for simple excision and for control of the surgical margins. Radiotherapy has been used to treat this tumor, either alone or in combination with surgery.[33,34] The results obtained enable us to draw the following conclusions:

1. Radiotherapy should not be used alone for a primary microcystic adnexal carcinoma, since it has been shown that not only is it ineffective against this tumor, but it can also make the tumor clinically and histologically more aggressive.[34,35]
2. Ionizing radiation can be considered as adjuvant therapy to surgical excision for tumors with disease-free margins in specific situations: recurrences; lymphatic, vascular, or perineural invasion; and muscle or bone invasion.[15,36,37]

Conventional surgery requires a wide safety margin, both superficially and deep, in order to minimize the risk of incomplete excision. However, the definition of a "wide" margin is somewhat vague; therefore, it is impossible to evaluate the results of conventional surgery over a large number of studies. In addition, analysis of the surgical specimen obtained using this technique only enables 0.2% of margins to be evaluated, thus leading to a recurrence rate of 40% to 60% during the first 3 years after treatment.[5]

MMS is a more selective approach to the volume of tissue removed, and minimizes excision of healthy skin; therefore, the aesthetic result is better, which is particularly important given that this type of tumor tends to appear on the face.[38] Similarly, the mode of extracting the specimen and its analysis make it possible to evaluate almost 100% of the surfaces of the surgical specimen,[20] with the result that the risk of recurrence using this technique varies from 0%[5] to 12%.[2,6,39,42] The postsurgical defect can reach up to 4 times the size of the initial clinical lesion.[5,43-45]

Table 2. Reports From the Literature of Patients With Microcystic Adnexal Carcinoma Treated With Mohs Surgery

	No. of Cases	Recurrence Rate	No. of Stages	Mean Follow-up, mo
Fleischmann et al[45], 1984	1	No	NS	7
Cooper and Mills[2], 1984	1 (recurrent)	Yes	NS	8
Nickoloff et al[8], 1986	1	No	4	13
Hamm et al[39], 1987	3 (2 recurrent)	No	NS	19
Mayer et al[35], 1988	3 (2 recurrent)	Yes (1 case)	NS	NS
Chow et al[43], 1989	1	No	NS	NS
Birkby et al[46], 1989	1 (recurrent)	No	NS	18
Wallace and Bernstein[47], 1991	1 case	No	NS	18
Futran et al[48], 1992	1 case	No	NS	1.5
Sebastien et al[18], 1993	1 (recurrent)	No	NS	16
Burns et al[49], 1994	10 (4 recurrent)	No	NS	25
McAlvany et al[50], 1994	1	No	1	32
Hazen and Bass[51], 1994	1 (recurrent)	Yes	NS	42
Hesse et al[44], 1995	1	No	NS	24
Barlow et al[27], 1996	2	No	1.5	24
Billingsley et al[7], 1996	4 (3 recurrent)	No	NS	31.4
Park and Parry[12], 1998	1	No	3	6
Friedman et al[31], 1999	11 (2 recurrent)	No	3.5	60
Chiller et al[5], 2000	25 (3 recurrent)	Yes (3 cases)	NS	38
Snow et al[52], 2001	13 (3 recurrent)	No	NS	60
Abbate et al[53], 2003	6 (2 recurrent)	No	NS	23.3
Khachemoune et al[54], 2005	4	No	4	12
Leibovitch et al[14], 2005	20 (4 recurrent)	No	2	60

Abbreviation: NS, not supplied.

Few series in the literature analyze patients treated with Mohs surgery, and the samples are small (Table 2). In our series, no patients presented signs of recurrence during the regular postsurgical follow-up, which ranged from 12 months to 12 years (mean, 5 years). The surgical defect reached 2-4 times the size of the initial clinical lesion.

Tumor recurrence in microcystic adnexal carcinoma is important, since, compared with primary microcystic adnexal carcinoma, recurrences present when larger in size, thus implying the need for a greater number of Mohs stages and a larger postsurgical defect. In histologic terms, greater cellular atypia is observed with a higher rate of perineural invasion (up to 80% of cases). All 6 cases in our series presented primary adnexal tumors, which showed mild cellular atypia and no perineural infiltration in the histopathologic analysis.

Therefore, MMS should be considered the treatment of choice for this type of tumor.

At present, neither the follow-up interval nor the necessary complementary tests for these patients has been established. Given the greater risk of recurrence during the first 3 years after excision, follow-up is recommended every 3 to 6 months. After the first 3 years, lifetime monitoring should be started, since there have been

reports of recurrence up to 30 years after the lesion was first removed.

Conflict of Interest

The authors declare no conflicts of interest.

References

1. Lipper S, Peiper SC. Sweat gland carcinoma with syringomatous features: a light microscopic and ultrastructural study. Cancer. 1979;44:157-63.

2. Cooper PH, Mills SE. Microcystic adnexal carcinoma. J Am Acad Dermatol. 1984;10:908-14.

3. Cooper PH, Mills SE, Leonard DD, Santa Cruz DJ, Headington JT, Barr RJ, et al. Sclerosing sweat duct (syringomatous) carcinoma. Am J Surg Pathol. 1985;9:422-33.

4. Goldstein DJ, Barr RJ, Santacruz DJ. Microcystic adnexal carcinoma: a distinct clinicopathologic entity. Cancer. 1982;50:566-72.

5. Chiller K, Passaro D, Scheuller M, Singer M, McCalmont T, Grekin RC. Microcystic adnexal carcinoma: forty-eight cases, their treatment, and their outcome. Arch Dermatol. 2000;136:1355-9.

6. Mole RH. Radiation induced tumors: human experience. Special report. Br J Radiol. 1972;45:613.

7. Billingsley EM, Fedok F, Maloney ME. Microcystic adnexal carcinoma, case report, and review of the literature. Arch Otolaryngol Head Neck Surg. 1996;122:179-82.

8. Nickoloff BJ, Fleischmann HE, Carmel J, Wood CC, Roth RJ. Microcystic adnexal carcinoma. Immunohistologic observations suggesting dual (pilar and eccrine) differentiation. Arch Dermatol. 1986;122:290-4.

9. Wick MR, Cooper PH, Swanson PE, Kaye VN, Sun TT. Microcystic adnexal carcinoma. An immunohistochemical comparison with other cutaneous appendage tumors. Arch Dermatol. 1990;126:189-94.

10. Bier-Laning CM, Hom DR, Gapany M, Manivel JC, Duvall AJ. Microcystic adnexal carcinoma: management options based on long-term follow-up. Laryngoscope. 1995;105:1197-201.

11. Ohtsuka H, Nagamatsu S. Microcystic adnexal carcinoma: review of 51 Japanese patients. Dermatology. 2002;204:190-3.

12. Park JY, Parry EL. Microcystic adnexal carcinoma. First reported case in a black patient. Dermatol Surg. 1998;24:905-7.

13. Peterson CM, Ratz JL, Sangueza OP. Microcystic adnexal carcinoma: first reported case in an African American man. J Am Acad Dermatol. 2001;45:283-5.

14. Leibovitch I, Huilgol SC, Selva D, Lun K, Richards S, Paver R. Microcystic adnexal carcinoma: treatment with Mohs micrographic surgery. J Am Acad Dermatol. 2005;52:295-300.

15. Clement CI, Genge J, O'Donnell BA, Lochhead AG. Orbital and periorbital microcystic adnexal carcinoma. Ophthal Plast Reconstr Surg. 2005;21:97-102.

16. Hunt JH, Patel BC, Langer PD, Anderson RL, Gerwels JW. Microcystic adnexal carcinoma of the eyebrow and eyelid. Arch Ophthalmol. 1995;113:1332-3.

17. Ong T, Liew SH, Mulholland B, Davis P, Calonje E. Microcystic adnexal carcinoma of the eyebrow. Ophthal Plast Reconstr Surg. 2004;20:122-5.

18. Sebastien TS, Nelson BR, Lowe L. Microcystic adnexal carcinoma. J Am Acad Dermatol. 1993;29:840-5.

19. Billingsley EM, Fedok F, Maloney ME. Microcystic adnexal carcinoma. Case report and review of the literature. Arch Orolaryngol Head Neck Surg. 1996;122:179-82.

20. Requena L, Marquina A, Alegre V, Aliaga A, Sánchez Yus E. Sclerosing (microcystic adnexal) carcinoma: a tumour from a single eccrine origin. Clin Exp Dermatol. 1990;15:222-4.

21. Pujol RM, LeBoit PE, Su WP. Microcystic adnexal carcinoma with extensive sebaceous differentiation. Am J Dermatopathol. 1997;19:358-62.

22. McCord MW, Mendenhall WM, Parsons JT, Amdur RJ, Stringer SP, Cassisi NJ, et al. Skin cancer of the head and neck with clinical perineural invasion. Int J Radiat Oncol Biol Phys. 2000;47:88-93.

23. Mendenhall WM, Amdur RJ, Williams LS, Mancuso AA, Stringer SP, Mendenhall NP. Carcinoma of the skin of the head and neck with perineural invasion. Head Neck. 2002;24:78-83.

24. Rapini RP. Comparison of methods for checking surgical margins. J Am Acad Dermatol. 1990;23:288-94.

25. Salerno S, Terrill P. Will MAC be back? Ann J Surg. 2003;73:830-2.

26. Bier-Laning CM, Horn DB, Gapany M, Manivel JC, Duvall AJ 3rd. Microcystic adnexal carcinoma: management options based on long-term follow-up. Laryngoscope. 1995;105:1197-201.

27. Barlow RJ, Ramnarain N, Smith N, Mayou B, Markey AC, Walker NPJ. Excision of selected skin tumours using Mohs' micrographic surgery with horizontal paraffin-embedded sections. Br J Dermatol. 1996;135:911-7.

28. Cooper PH. Sclerosing carcinomas of sweat ducts (microcystic adnexal carcinoma). Arch Dermatol. 1986;122:261-4.

29. Billingsley EM. Microcystic adnexal carcinoma. In: Miller SJ, Maloney ME, editors. Cutaneous oncology, pathophysiology, diagnoses, and management. Oxford: Blackwell Science; 1998. p. 722-8.

30. Rotter N, Wagner H, Fuchshuber S, Issing WJ. Cervical metastases of microcystic adnexal carcinoma in an otherwise healthy woman. Eur Arch Otorhinolaryngol. 2003;260:254-7.

31. Friedman PM, Friedman RH, Jiang SB, Nouri K, Amonette R, Robins P. Microcystic adnexal carcinoma: collaborative series review and update. J Am Acad Dermatol. 1999;41:225-31.

32. Gabillot-Carré M, Weill F, Mamelle G, Kolb F, Boitier F, Petrow P, et al. Microcystic adnexal carcinoma: report of seven cases including one with lung metastasis. Dermatology. 2006;212:221-8.

33. Ohta M, Hiramoto M, Ohtsuka H. Metastatic microcystic adnexal carcinoma: an autopsy case. Dermatol Surg. 2004;30:957-60.

34. Stein JM, Ormsby A, Esclamado R, Bailin P. The effect of radiation therapy on microcystic adnexal carcinoma: a case report. Head Neck. 2003;25:251-4.

35. Mayer MH, Winton GB, Smith AC, Lupton GP, Parry EL, Shagets FW. Microcystic adnexal carcinoma (sclerosing sweat duct carcinoma). Plast Reconstr Surg. 1989;84:970-5.

36. Harari PM, Shimm DS, Bangert JL, Cassady JR. The role of radiotherapy in the treatment of malignant sweat gland neoplasms. Cancer. 1990;65:1737-40.

37. Yugueros P, Kane WJ, Goellner JR. Sweat gland carcinoma: a clinicopathologic analysis of an expanded series in a single institution. Plast Reconstr Surg. 1998;102:705-10.

38. Alonso T, Sánchez P, González A, Ingelmo J, Ruiz I, Delgado S, et al. Cirugía de Mohs: nuestros primeros cien pacientes. Actas Dermosifiliogr. 2008;99:275-80.

39. Hamm JC, Argenta LC, Swanson NA. Microcystic adnexal carcinoma: an unpredictable aggressive neoplasm. Ann Plast Surg. 1987;19:173-80.

40. Lober CW, Larbig CG. Microcystic adnexal carcinoma (sclerosing sweat duct carcinoma). South Med J. 1994;87:259-62.

41. Robinson ML, Knibbe MA, Roberson JB. Microcystic adnexal carcinoma: report of a case. J Oral Maxilofac Surg.1995;53:846-9.

42. Hunt JT, Stack BC Jr, Futran ND, Glass LF, Endicott JN. Pathologic quiz case 1. Microcystic adnexal carcinoma (MAC). Arch Otolaryngol Head Neck Surg. 1995;121:1430-3.

43. Chow WC, Cockerell CJ, Geronemus RG. Microcystic adnexal carcinoma of the scalp. J Dermatol Surg Oncol. 1989;15:768-71.

44. Hesse RJ, Scharfenberg JC, Ratz JL, Greisner E. Eyelid microcystic adnexal carcinoma. Arch Ophthalmol. 1995; 113:494-6.

45. Fleischmann HE, Roth RJ, Wood C, Nickoloff BJ. Microcystic adnexal carcinoma treated by microscopically controlled excision. J Dermatol Surg Oncol.1984;10:873-5.

46. Birkby CS, Argenyi ZB, Whitaker DC. Microcystic adnexal carcinoma with mandibular invasion and bone marrow replacement. J Dermatol Surg Oncol. 1989;15:308-12.

47. Wallace RD, Bernstein PE. Microcystic adnexal carcinoma. Ear Nose Throat J. 1991;70:789-93.

48. Futran ND, Quatela VC, Presser SE, Muhlbauer JE. Microcystic adnexal carcinoma of the lower lip. Otolaryngol Head Neck Surg. 1992;107:457-9.

49. Burns MK, Chen SP, Goldberg LH. Microcystic adnexal carcinoma. Ten cases treated by Mohs micrographic surgery. J Dermatol Surg Oncol. 1994;20:429-34.

50. McAlvany JP, Stonecipher MR, Leshin B, Prichard E, White W. Sclerosing sweat duct carcinoma in an 11-year-old boy. J Dermatol Surg Oncol. 1994;20:767-8.

51. Hazen PG, Bass J. Microcystic adnexal carcinoma: successful management using Mohs' micrographically-controlled surgery. Int J Dermatol. 1994;33:801-2.

52. Snow S, Madjar DD, Hardy S, Bentz M, Lucarelli MJ, Bechard R, et al. Microcystic adnexal carcinoma: report of 13 cases and review of the literature. Dermatol Surg. 2001;27: 401-8.

53 Abbate M, Zeitouni NC, Seyler M, Hicks W, Loree T, Cheney RT. Clinical course, risk factors, and treatment of microcystic adnexal carcinoma: a short series report. Dermatol Surg. 2003;29:1035-8.

54. Khachemoune A, Olbricht SM, Johnson DS. Microcystic adnexal carcinoma: report of four cases treated with Mohs' micrographic surgical technique. Int J Dermatol. 2005; 44:507-12.