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REVIEW

Reticular erythematous mucinosis: a systematic review of a controversial entity

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ABSTRACT

INTRODUCTION: Reticular erythematous mucinosis (REM) is a rare chronic dermatosis, predominantly affecting middle age women, characterized by net-like macules and patches on the chest and back. The etiology of REM is uncertain, though associations with environmental, hormonal, and autoimmune factors have been suggested.
EVIDENCE ACQUISITION: This systematic review of 62 studies, involving 129 patients, analyzes the clinical, histopathological, and therapeutic aspects of REM.
EVIDENCE SYNTHESIS: Findings indicate consistent mucin deposition in the dermis, a predominant lymphocytic infiltrate, and a frequent association with comorbidities like thyroid disorders and autoimmune diseases. Antimalarial medications, particularly hydroxychloroquine, are highlighted as the most effective treatment, though the disease may relapse upon cessation.
CONCLUSIONS: This review emphasizes REM as a distinct clinical entity and underscores the need for further research to refine diagnostic criteria and treatment protocols.

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KEY WORDS: Mucinoses; Skin diseases; Cutaneous lupus erythematosus.

Introduction

Reticular erythematous mucinosis (REM) is a rare and chronic condition classified under primary cutaneous mucinoses. First described by Steigleder in 1974, REM typically presents as net-like, confluent macules, patches, or ill-defined plaques, primarily located on the anterior chest and upper back, with less frequent occurrences on the legs, arms, or abdomen.[1] Histopathologically, REM is characterized by a discrete or abundant, diffuse mucin deposition between collagen bundles in the superficial and mid dermis associated to a perivascular and perifollicular superficial lymphocytic infiltrate with the epidermis generally spared.[2]

Despite the chronic nature and persistent lesions, REM is usually asymptomatic and is more frequently reported in younger to middle-aged women, with initial appearances in children being uncommon.[3] Most cases of REM are sporadic, with only a few familial cases documented. The exact etiology of REM remains unclear, though factors such as exposure to heat, radiotherapy, hormonal changes (*e.g.*, menstruation, pregnancy, oral contraceptives), viral infections, and immunologic dysfunction have been suggested as potential triggers or exacerbating factors.[2] The relationship between REM and inflammatory or autoimmune disorders is not well understood, though associations with autoimmune diseases such as Hashimoto thyroiditis, systemic lupus erythematosus, tumid lupus erythematosus (TLE), diabetes, and idiopathic thrombocytopenic purpura have been reported.[4, 5]

Treatment primarily involves antimalarial medications, which have led to prompt resolution of lesions in many

cases, although alternative treatments are also being explored with varying success.[2]

Due to the rarity of REM, the literature consists mainly of limited case series and individual case reports, reflecting the limited understanding of this condition. To address this gap, we conducted a comprehensive review of REM cases documented in the literature, aiming to elucidate potential features and associations that could contribute to a deeper understanding of the disease.

Evidence acquisition

A systematic search for studies on REM was conducted by three indipendent reviewers across electronic databases, including MEDLINE (PubMed), Web of Science, and Scopus. The search utilized key words such as "reticular erythematous mucinosis," "REM dermatology," and "Steigleder's Syndrome." Studies from inception to March 2024 were considered. After removing duplicates, abstracts were independently reviewed to assess compliance with inclusion and exclusion criteria.

Inclusion criteria:

- clinical and histological diagnosis of REM.

Exclusion criteria:

- non-English language;
- unavailability in library resources.

Data extracted during screening included the first author, year of publication, number of patients, gender, age, anatomical site of involvement, comorbidities, photosensitivity, symptoms, blood test results (such as anti-nuclear antibodies [ANA] and extractable nuclear antigen [ENA]), duration of symptoms prior to diagnosis, treatments administered, and follow-up information. Histological details, including epidermal, dermal, and dermoepidermal junction findings, mucin deposition, immunofluorescence, and immunohistochemical data, were also recorded. A qualitative synthesis of evidence was performed to summarize the findings from included primary publications.

Evidence synthesis

A total of 263 papers were initially identified, and after removing duplicates, 190 papers were excluded based on title and abstract screening (Figure 1). Subsequently, 73 full-text articles were evaluated for eligibility, leading to the inclusion of 62 papers in the qualitative synthesis.

The results are summarized in Table I.[1-61]

The review encompassed data from 129 patients, with a mean age of 46 years, ranging from 8 to 75 years. The majority of patients were female (62%, N.=80), while males accounted for 38% (N.=49). The mean delay to diagnosis was 51.5 months.

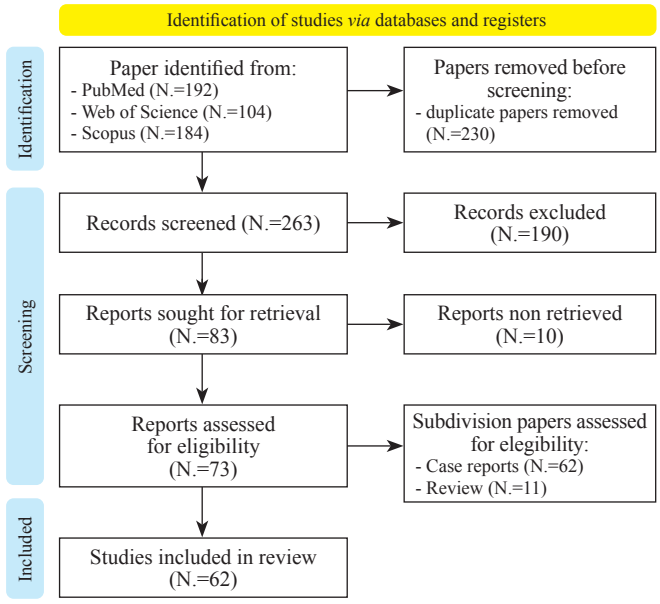

Figure 1.—PRISMA flow chart of the study selection.

The clinical presentation of REM was diverse among patients. Skin lesions were variable: 38 (29.5%) presented with erythematous macules with a reticular pattern, 37 (28.7%) exhibited erythematous macules and papules with a reticular pattern, and other 37 (28.7%) had erythematous macules, papules, plaques with a reticular pattern, or isolated plaques.

The anatomical distribution of skin lesions showed a predominance on the trunk, particularly the chest and back, either as isolated sites or as part of more complex multisite presentations. The chest was the most frequently affected area, with a total of 94 patients (72.9%) presenting lesions, while the back was also commonly involved, affecting 85 patients (65.9%). Isolated involvement of the chest and back was observed in 22 (17%) and 13 patients (10%), respectively, while the remaining cases involved these areas in combination with other regions. Multisite involvement was frequently observed, with the most common pattern being the combination of chest and back, found in 40 patients (31%). Other recurrent distributions included chest, back, and abdomen (13 patients, 10%), chest, back, and neck (eight patients, 6.2%), as well as chest, back, face, and arms (seven patients, 5.4%). Less frequent combinations were chest, back, and face (three patients, 2.3%), face, neck, and arms (two patients, 1.5%),

TABLE I.—*Main characteristics of patients with reticular erythematous mucinosis (N.=129).*

Characteristics	N. (%)
Age, mean (range)	46 (8-75)
Gender	
Males	49 (38%)
Females	80 (62%)
Delay to diagnosis, mean	51.5
Skin lesions	
Erythematous macules with reticular pattern	38 (29.5%)
Erythematous macules/papules with reticular pattern	37 (28.7%)
Erythematous macules/papules/ plaques with reticular pattern and isolated plaques	37 (28.7%)
N/A	17 (13.1%)
Symptoms	
Itch	41 (31.8%)
Slight burning sensation	3 (2.3%)
Absent	55 (42.6%)
N/A	30 (23.3%)
Sites involved, n (%)	
Chest	22 (17%)
Back	13 (10%)
Limbs (arms or legs)	7 (5.4%)
Multiple sites	
Chest and back	40 (31%)
Chest, back and abdomen	13 (10%)
Chest, back and neck	8 (6.2%)
Chest, back, face and arms	7 (5.4%)
Chest, back and face	3 (2.3%)
Face, neck and arms	2 (1.5%)
Chest, neck and abdomen	1 (0.8%)
N/A	13 (10%)
Sunlight exposure	
Worsening	47 (36.4%)
Improvement	2 (1.6%)
No influence	28 (21.7%)
N/A	52 (40.3%)
Phototesting	
Patients studied for minimal erythema dose	32 (24.8%)
diminished	6 (4.7%)
normal	26 (20.2%)
Patients studied with repeated provocation testing	31 (24.1%)
Positive	7 (5.4%)
Negative	24 (18.6%)
N/A	66 (51.2%)
Influence of hormonal factors (menstruation, contraceptive pill)	
Worsening	4 (5%)*
Associated conditions	
Malignancies	13 (10.1%)
Thyroid disease	9 (7%)
Rheumatic disease	9 (7%)
Infectious disease	4 (3.1%)
None	60 (46.5%)
N/A	34 (26.4%)
Treatment	
Efficacy, N. responders/n treated (%)	
Hydroxychloroquine	39/54 (72.2%)
Chloroquine	13/16 (81.2%)
Mepacrine	7/8 (87.5%)
Topical steroids	4/25 (16%)
Calcineurin inhibitors	1/4 (25%)
Phototherapy	3/6 (50%)
Laser therapy	1/2 (50%)
Histopathology	
Epidermis	
Normal	72 (55.8%)
Flattened	11 (8.5%)
Spongiosis	9 (7%)
Parakeratosis	7 (5.4%)
Hyperkeratosis	6 (4.7%)
Acanthosis	4 (3.1%)
N/A	20 (15.5%)
Dermis	
Lymphocytic infiltrate	
Perivascular and perifollicular	
In superficial and mid-dermis	27 (20.9%)
In superficial dermis	11 (8.5%)
In superficial and deep dermis	7 (5.4%)
Only perivascular	
In superficial dermis	11 (8.5%)
In superficial and deep dermis	2 (1.6%)
In superfical and mid-dermis	1 (0.8%)
In mid dermis	1 (0.8%)
Only perifollicular	
In upper dermis	1 (0.8%)
In deep dermis	1 (0.8%)
Aspecific infiltrate	8 (6.2%)
N/A	59 (45.7%)
Edema	13 (10%)
N/A	116 (90%)
Mucin deposition	
Present (distribution not known)	55 (42.6%)
Present in superficial dermis	41 (31.8%)
Present superficial and mid dermis	8 (6.2%)
Present in superficial and deep dermis	13 (10.1%)
Not increased	1 (0.8%)
N/A	11 (8.5%)
Direct immunofluorescence	
IgM deposit at dermoepidermal junction	13 (10%)
IgG deposit at dermoepidermal junction	2 (1.5%)
IgA deposit at dermoepidermal junction	3 (2.3%)
C3 at dermoepidermal junction and superficial vessels	8 (6.2%)
IgM deposit in papillary dermis	2 (1.5%)
Negative	37 (28.7%)
N/A	64 (50%)
Immunohistochemistry	
Predominantly lymphocytes	29 (22.5%)
Predominantly neutrophils	2 (1.5%)
Negative	1 (0.8%)
N/A	97 (75%)
CD123	
Positive	4 (3%)
Negative	5 (4%)
N/A	120 (93%)

*N.=80.

(To be continued)

and chest, neck, and abdomen (one patient, 0.8%).Symptomatology varied among the study population. A total of 41 (31.8%) patients reported itching, only three (2.3%) experienced a slight burning sensation, while symptoms were absent in 55 (42.6%).

Sunlight exposure was reported to influence the disease course in some patients. A total of 47 (36.4%) patients reported worsening of their condition with sun exposure, while two (1.6%) noted improvement. Instead, no influence was reported in 28 (21.7%).

Phototesting was performed in a subset of patients to assess their response to ultraviolet (UV) radiation. Among those studied for minimal erythema dose (MED) (32, 24.8%), a diminished dose was observed in six (4.7%), while 26 (20.2%) demonstrated normal values. Additionally, repeated provocation testing was conducted in 31 (24.1%) patients, yielding positive results in seven (5.4%) and negative results in 24 (18.6%).

The role of hormonal factors was evaluated among the female patients, and four (5%) reported worsening of symptoms in association with menstruation or contraceptive pill use.

Associated conditions were identified in a subset of patients. Malignancies were present in 13 (10.1%), thyroid disease in nine (7%), rheumatic disease in nine (7%), and infectious disease in four (3.1%).

Various treatment modalities were employed to manage the disease. Hydroxychloroquine was the most frequently used treatment (54, 41.8%), showing an efficacy rate of 39 (72.2%). Chloroquine was administered to 16 (12.4%) patients, with 13 (81.2%) reporting improvement. Mepacrine was used in eight (6.2%) cases, showing an efficacy in seven (87.5%). Topical steroids were applied in 25 (19.3%) cases, but only four (16%) experienced significant benefits. Calcineurin inhibitors were used in four (3.1%) patients, with a response in one (25%). Phototherapy was employed in six (4.7%), with three (50%) achieving improvement. Laser therapy was used in two (1.6%), with one (50%) responding positively.

With regard to the histopathological component, results showed a normal epidermis in 72 (55.8%) cases, while in others, flattening (11, 8.5%), spongiosis (9, 7%), parakeratosis (7, 5.4%), hyperkeratosis (6, 4.7%), and acanthosis (4, 3.1%) were found.

Dermal infiltrates predominantly consisted of lymphocytes, with perivascular and perifollicular involvement in the superficial and mid-dermis (27, 20.9%), superficial dermis (11, 8.5%), or superficial and deep dermis (7, 5.4%). Purely perivascular infiltrates were present in the superficial dermis (11, 8.5%), superficial and deep dermis (2, 1.6%), superficial and mid-dermis (1, 0.8%), and mid-dermis only (1, 0.8%). Purely perifollicular infiltrates were rare, occurring in the upper dermis (1, 0.8%) and deep dermis (1, 0.8%). Edema was detected in 13 (10%).

Mucin deposition was observed in the majority of patients. In 55 cases (42.6%), mucin was reported as present, although without specification of its anatomical distribution within the dermis. When described, mucin was most frequently localized into the superficial dermis, found in 41 patients (31.8%). Involvement of both the superficial and mid dermis was noted in 8 patients (6.2%), while deposition extending from the superficial to the deep dermis was observed in 13 patients (10.1%). In only one case (0.8%) mucin was reported as not increased.Direct immunofluorescence showed IgM deposits at the dermoepidermal junction in 13 (10%) cases, IgG deposits in two (1.5%), IgA deposits in three (2.3%), and C3 deposits at the dermoepidermal junction and superficial vessels in 8 (6.2%). IgM deposits were found in addition in the papillary dermis in 2 (1.5%), while 37 (28.7%) had negative findings. The deposits at the dermoepidermal junction predominantly exhibited a granular pattern in 13 (93%) analyzed cases, while a linear deposition was observed in only one.

Immunohistochemistry findings were present in a limited number of cases and showed lymphocytic infiltrates in 29 (22.5%) and neutrophilic infiltrates in two (1.5%).

CD123 expression was assessed in a small subset of patients and positivity was detected in four (3%) cases, while five (4%) were negative.

Discussion

REM remains poorly understood in both clinical practice and scientific literature, with most information drawn from limited case series and anecdotal reports. These sparse publications are crucial for advancing knowledge but hinder definitive conclusions and standardized treatment guidelines. Our systematic review aims to provide a more comprehensive understanding of REM by analyzing studies on its clinical features, associated conditions, histopathology, and treatment responses.

REM predominantly affects middle-aged females, with an average onset age of around 46 years. All studies consistently identify the chest and back as the primary locations for REM lesions, supporting the notion that these areas are commonly affected due to their higher exposure to environmental factors. Our review identified that this condition is characterized by macules arranged in a net-like pattern,

with papules present in a similar distribution, occasionally coalescing into plaques (Figure 2A), highlighting the complexity of REM and the importance of a comprehensive dermatological evaluation for precise diagnosis.

Approximately one-third of patients exhibited photosensitivity, suggesting a possible correlation with UV exposure. However, retrospective analyses revealed varied responses to sunlight, with some cases improving while others experienced exacerbation or lesion induction. The majority of patients tested for MED showed normal results, and most individuals who underwent repeated provocation testing had negative findings, indicating that direct UV exposure may not consistently act as a trigger for REM in most cases. It is noteworthy that, concerning the MED, Yamazaki observed that the same patient had a normal reaction to UVA rays but a reduced response to UVB rays.[29] Similarly, Adamski reported that three patients had a negative repeated provocation test for UVB rays and a positive response for UVA rays.[37] These findings emphasize the nuanced relationship between REM and UV radiation, highlighting the necessity for individualized patient assessments.

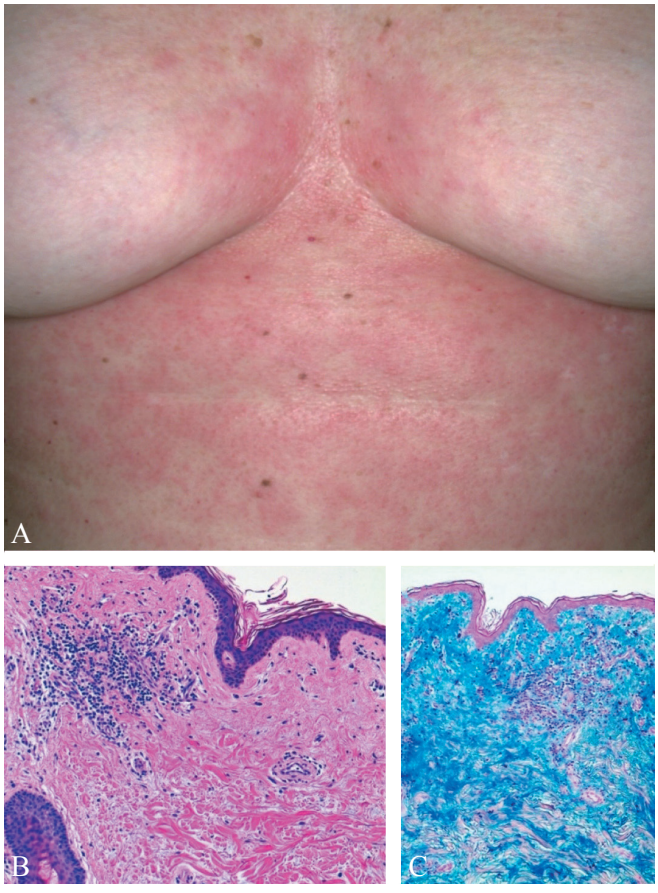

Figure 2.—A) Clinical image of REM: erythematous macules and indurated papules with a reticular configuration on the central chest of a middle age woman; B) histopathology of REM: perivascular and perifollicular predominantly lymphocytic infiltrate with vascular dilatation and separation of collagen bundles (hematoxylin and eosin staining, original magnification, ×10); C) Interstitial mucin deposition in the upper and mid dermis (Alcian blue staining, original magnification x4).

Various studies identify related comorbidities, including malignancies and thyroid disorders. Our systematic review also notes a significant prevalence of onco-hematological diseases, thyroid disorders, rheumatic diseases and infectious diseases. The identification of Borreliosis in one patient and HIV in two others adds a unique perspective on potential infectious links with REM, suggesting an area for further investigation into the etiological factors.[2]

Immunological tests, such as ANA or ENA, showed very low positivity rates, indicating that autoimmunity per se is not a predominant characteristic of REM.

Histopathological analysis reveals consistent findings across all studies, which are crucial criteria for diagnosis, including diffuse mucin deposition in the superficial and mid dermis associated to a perivascular and perifollicular lymphocytic infiltrate with absent or minimal epidermal alterations. (Figure 2B, C) Immunohistochemistry showed that the infiltrate was predominantly T-lymphocytic, with neutrophils present in only a few cases. Positivity for CD123, indicative of the presence of plasmacytoid dendritic cells, was minimal; however, its expression was assessed in only a limited number of cases, which may limit the interpretability of this finding. Direct immunofluorescence was performed in a limited number of cases, revealing immunoglobulin deposits in a minority of them, with the predominant pattern being in a granular disposition.

The differential diagnosis of REM primarily includes TLE. It remains controversial whether REM and TLE represent distinct entities or are merely different manifestations of the same disease. The most extensive case series of REM have provided arguments for distinguishing between REM and TLE. Histopathologically, the differentiation from TLE can be made by the absence of epidermal atrophy or involvement, lack of basal membrane thickening, presence of mucin deposits more superficially in REM and deeper in TLE, and the presence of a follicular tropism of the infiltrate in TLE. Conversely, sex, incidence, response to antimalarials, and the relationship with sun exposure may be common features between TLE and REM.[53, 62]

Dermatomyositis (DM) is another potential clinical differential, but DM typically occurs in sun-exposed areas, not exclusively on the trunk, with the classic presentation

of eliotropic erythema on the face and Gottron's papules on the dorsum of the hands. Although dermal mucin deposits are also found in DM, the lack of epidermal atrophy, hyperkeratosis, and basal cell vacuolar change in REM can help rule out this possibility.[53]

Additional differential diagnoses include Jessner's lymphocytic infiltration, palpable arciform migratory erythema and polymorphic light eruption.[37, 53]

Jessner's lymphocytic infiltration is characterized by asymptomatic erythematous papules or plaques with central clearing, primarily affecting sun-exposed areas such as the face, neck, and more rarely the trunk. Histological examination reveals a dense perivascular and periadnexal lymphocytic infiltrate within the dermis, primarily composed of CD8+ T cells, with sometimes a few B-cells and clusters of plasmacytoid dendritic cells. The epidermis typically appears normal, without atrophy or follicular plugging. Mucin deposition is not considered as a microscopic feature.[37] Moreover, the classification of Jessner's lymphocytic infiltration as a distinct disease has been debated and the disease has not been considered anymore a separate condition, but rather a clinicopathologic reaction pattern shared by various skin diseases, primarily TLE.[53, 63]

Palpable migratory arciform erythema is an exceptionally rare skin condition whose classification remains also debated, ranging from a distinct disease or a subtype of T-cell pseudolymphoma to a variant of Jessner's lymphocytic infiltrate or erythema annulare centrifugum. It affects middle-aged adults, presenting as migratory annular erythematous lesions, primarily on the upper trunk, arms, and thighs. Lesions evolve dynamically and may spontaneously regress. Histologically, a moderate to abundant perivascular, and periadnexal lymphocytic infiltrate throughout the reticular dermis, with no epidermal involvement nor mucin deposition is found. Lymphocytes are predominantly T cells with a small B cell and histiocytic and eosinophilic component.[53, 64]

Polymorphic light eruption is a photodermatosis characterized by a heterogeneous presentation with macular, papular, papulovesicular, urticarial, erythema multiforme-like and plaque-like variants that develops a few hours to several days after sun exposure on the upper chest, upper arms, backs of the hands, thighs, and the sides of the face. Histopathology shows spongiosis, subepidermal edema and a mixed, predominantly lymphoid perivascular infiltrate in the superficial and deep dermis, but lacks the deposition of mucin.[37, 53, 65]

Hydroxychloroquine emerges as a highly effective treatment in most studies, with benefits reported in most of cases. All studies emphasize the necessity of careful monitoring due to potential side effects and the possibility of relapse upon discontinuation. Chloroquine and Mepacrine, although less commonly used, may also demonstrate good efficacy. Topical treatments, including steroids and calcineurin inhibitors, have shown limited success, underscoring the need for systemic treatments in most cases. Light-based therapies, although used in a limited number of cases, were noted as beneficial, but required careful patient selection due to potential exacerbation of lesions, highlighting the nuanced approach needed for different therapeutic modalities.

Conclusions

Our systematic review deepens the understanding of REM's clinical presentation, associated conditions, histopathological features, and treatment responses. It reveals that REM is a distinct clinical entity characterized by specific lesion distribution in the midline of the trunk and histopathological findings, despite some overlapping features with conditions like TLE.

Due to the rarity of the condition and the limited body of research available, this review faces several limitations: the small number of reported cases may limit the generalizability of findings and hinder the ability to draw robust conclusions; the heterogeneity of diagnostic criteria and treatment approaches across studies may introduce inconsistencies and make comparisons difficult; the lack of long-term follow-up data in most studies limits understanding of the chronicity and progression of the disease; finally, publication bias and the lack of randomized controlled trials further limit the ability to make evidence-based recommendations.

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Conflicts of interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Authors' contributions

Franco Rongioletti has given substantial contributions to the conception or the design of the manuscript, Gianmarco D. Bigotto, Marco Piras and Sveva Lenti to acquisition, analysis and interpretation of the data. All authors have participated to drafting the manuscript and revised it critically. All authors read and approved the final version of the manuscript.

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