

CASE REPORT

Open Access



# Chemotherapy induced juvenile dermatomyositis: a novel presentation- a case report

Keta Vagha<sup>\*</sup> , Chitturi Venkata Sai Akhil, Spandana Madirala , Ashish Varma , Mahaveer Lakra and Jayant Vagha

## Abstract

**Background:** Idiopathic connective tissue disease juvenile dermatomyositis (JDM) is characterised by inflammatory myositis and distinctive skin abnormalities. Only a few cases of Dermatomyositis (DM) owing to chemotherapy used to treat cancer have been reported, despite the fact that the link between DM and cancer in adults is widely known. We describe the case of a female, age 14, who experienced DM as a side effect of chemotherapy following enucleation for retinoblastoma. We also discussed our patient's likely pathophysiology of JDM after treatment.

**Case presentation:** A 14-year-old female came to our facility complaining of trouble walking and bluish-black discoloration on her neck, elbows, forehead, and knees that had been present for eight months. The patient had undergone enucleation of the left eye due to retinoblastoma, followed by 40 cycles of radiation therapy and 13 cycles of chemotherapy with Cyclophosphamide, Etoposide, Carboplatin, Vincristine, and Dactinomycin. Her serum LDH and CPK levels were high, and she tested positive for ANA. The muscle biopsy was consistent with the changes of DM. When electromyography was performed, it revealed tiny, fibrillating, polyphasic motor unit potentials and sharp, positive waves that were suggestive with DM. A diagnosis of JDM was made after taking into account the symptoms, biochemical data, muscle biopsy, and electromyography results. The patient's symptoms started to get better once methotrexate and oral corticosteroids were started.

**Conclusion:** This case report emphasises the value of ongoing observation after cancer chemotherapy because specific cutaneous and muscle symptoms may lead paediatricians to consider the possibility of chemotherapy-induced JDM, which is uncommon in young patients.

**Keywords:** Dermatomyositis, Chemotherapy, Malignancy, Inflammatory myositis

## Introduction

DM is a type of idiopathic inflammatory myopathy that manifests as gradual, symmetrical weakening in the proximal muscles as well as characteristic cutaneous changes [1]. It could involve different organs like the heart, stomach, intestines, lungs, etc. Despite being uncommon,

DM is the most common form of idiopathic inflammatory myopathy. According to reports in the adult population, 15 to 30 percent of DM patients have an underlying malignancy, and these individuals have a 5–7 times higher risk of getting cancer than the general population [2]. However, there is a dearth of such information regarding children. Post-chemotherapy DM is a rare occurrence, especially in kids. Here, we describe a rare instance of JDM that manifested in a girl aged 14 after undergoing 40 cycles of radiotherapy and 13 cycles of chemotherapy following enucleation for retinoblastoma.

\*Correspondence: kvagha@gmail.com

Department of Pediatrics, Jawaharlal Nehru Medical College, Acharya Vinoba Bhave Rural Hospital, Sawangi Meghe, Wardha, Maharashtra, India



© The Author(s) 2022. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

The title of our case, "Chemotherapy caused Juvenile Dermatomyositis," so distinguishes it from others.

### Case presentation

A 14-year-old female came to our facility with concerns about difficulty in walking owing to weakness in both lower limbs, an erythematous, pruritic rash that covered her face, neck, axilla, elbows, and knees, and photosensitivity that had been present for eight months. It was unknown if she had any allergies. Patient underwent surgery 1.5 years after being diagnosed with retinoblastoma two years prior. After the enucleation, the patient underwent 40 cycles of radiation therapy and 13 cycles of chemotherapy with the drugs cyclophosphamide, etoposide, carboplatin, vincristine, and dactinomycin. In addition to developing proximal muscular weakness in both the upper and lower body after undergoing chemotherapy for 10 months, the patient also got a rash over their face that progressed.

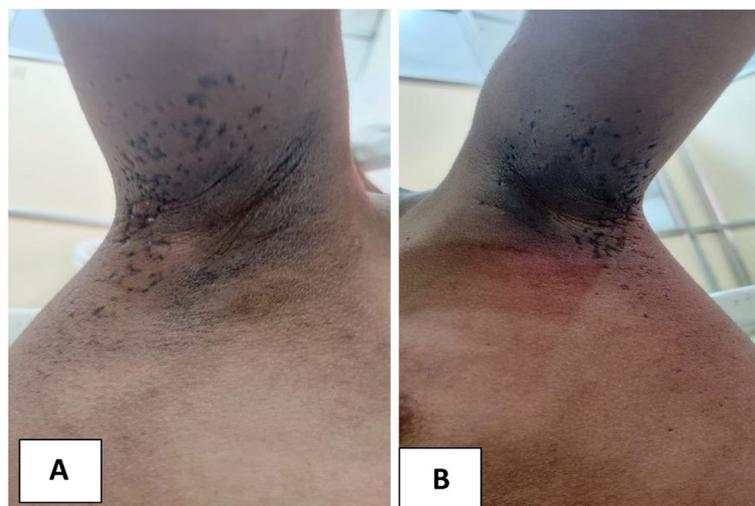
The patient was brought with these issues to our facility. Indicators of the patient's weakness in the proximal muscles of the upper and lower limbs were difficulty in rising from a sitting position and lifting the arms over the head. Her lower limbs had grade II muscle power and her upper limbs grade III, according to the examination. The CMAS score for childhood myositis was 36. Her vital signs were normal, and she had no underlying systemic issues. On inspection of the joints, there were no indications of active synovitis. At presentation, her neck flexor strength was higher than grade IV. Findings of skin examination showed hallmark manifestations consistent with DM, well defined to ill defined hyperpigmented scaly lichenified plaques over the neck, face, axilla (Fig. 1A,

1B), elbows, knees, including the V neck sign/Shawl sign (Fig. 2A), heliotrope eruption over the face especially on the forehead and periorbital region (Fig. 2B), Gottron papules over the digits of upper limb on both sides (Fig. 2C), calcinosis cutis involving the extensor aspect of elbows (Fig. 2D).

The initial blood tests, such as complete blood counts, liver and renal functions, were all normal. Both lactate dehydrogenase (578 U/L) and creatine phosphokinase (171.61 U/L) levels were high. Positive antinuclear antibodies were found. Features of Dermatomyositis with interface dermatitis and mucin deposition in the dermis was consistent in the skin punch biopsy. Electromyography was done which showed small polyphasic motor unit potentials with fibrillations, positive sharp waves suggestive of Dermatomyositis. A muscle biopsy revealed fibres of the muscle that were necrosed and fragmented [Fig. 3].

According to the online calculator of EULAR/ACR classification for Juvenile Idiopathic Inflammatory Myopathies (IIM), the criterion score was 15.7, which was suggestive of Definite IIM [3]. According to the Bohan and Peter criteria [4], JDM was determined to be the cause of the symptoms, which included the characteristic heliotrope rash with Gottron papules, symmetrical proximal weakness, raised muscle enzyme levels, electromyographic alterations, and even JDM-related changes in the muscle biopsy.

Prednisolone oral 2 mg/kg/day and methotrexate oral 15 mg/m<sup>2</sup> once weekly were started on the patient. After beginning the therapy for a week, the youngster displayed a slight improvement in symptoms as shown by lessened joint discomfort, stiffness, and erythema. Exercises for muscle strengthening and physiotherapy were started.



**Fig. 1** A and B show the lichenified plaques in the right and left axilla



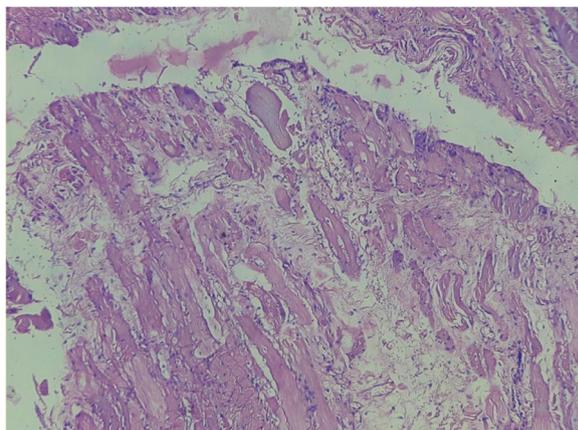
**Fig. 2** **A** The V neck sign/Shawl sign on the neck and upper chest. **B** Heliotrope rash with erythema over the face, Arrow represents the site of enucleation. **C** Gottron's papules over the digits which are in the healing stage. **D** Pearly white lesion on the extensor aspect of the elbow showing Calcinosis cutis

During the patient's future hospital visits, it was seen that the patient's muscle strength had significantly improved.

### Discussion

DM is a female-predominant idiopathic autoimmune connective tissue disease that is frequently accompanied by proximal muscle weakness and skin rashes [5]. The degree of cutaneous and muscular symptoms varies, and DM can be categorised as:

- Classic DM: It is characterised by simultaneous cutaneous and muscle involvement [6].
- Amyopathic DM: Despite having cutaneous indications that are consistent with DM for at least six months, these individuals lack muscular weakness and show no laboratory or radiologic evidence of myositis [6].
- Hypomyopathic DM: Muscle enzyme serologic tests, electromyography, muscle biopsy, or magnetic resonance imaging all show subclinical signs of myositis (MRI) [6].



**Fig. 3** Given section stained with Hematoxylin and Eosin (low power view: 10x) shows fibroadipose tissue, blood vessels and chronic inflammatory response around the blood vessels (perivascular). Muscle fibres in the dermis appear necrosed and fragmented

- Postmyopathic DM: When muscle illness is treated with immunosuppressive medication, cutaneous symptoms continue to exist [6].

Obtaining a thorough history and doing a physical examination are part of the first workup for DM cases. The severity of muscle weakness does not always correspond to the degree of CK increase [7]. Elevated levels of lactate dehydrogenase, aspartate aminotransferase, and alanine aminotransferase can also be seen, indicating muscular involvement. Nearly 60% of patients have negative antinuclear antibody levels [7]. Up to 80% of cases have myositis-specific antibodies, which can help define a serologic profile and indicate extramuscular symptoms and prognosis [8]. Our case report had a limitation that we were unable to test the myositis-specific antibodies (MSAs) and myositis-associated antibodies (MAAs), which prevented us from being clear about the subgroup of DM. For use in clinical and research settings, the EULAR/ACR classification criteria for Juvenile IIM provide a patient’s likelihood of having IIM [3]. The likelihood is determined by adding the weights assigned to a group of criteria elements, which results in a score.

Numerous malignancies, including breast, ovarian, lung, and hematologic cancers as well as nasopharyngeal

carcinoma in Asian populations, have been linked to DM. When DM is diagnosed, a thorough check for cancer is crucial. Here, we present a rare instance of DM brought on by post-enucleation chemotherapy and radiation treatment for retinoblastoma. Our case report has special significance because it is rather rare for DM to occur after a cancer diagnosis and chemotherapy.

Operative stress and chemotherapy are two suggested pathogenic potentials (Fig. 4) [9]. JDM may potentially result from a Th1/Th2 immune system imbalance, according to a theory [10]. Chemotherapy may have played a significant role in the development of JDM in our case because the cutaneous signs of JDM only emerged after the start of chemotherapy. In general, chemotherapy suppresses the immune system and treats autoimmune diseases. There have been reports that chemotherapy exposes tumour cell antigens and triggers autoimmune [10]. Since the patient had undergone surgery long before developing complaints, we considered chemotherapy for the development of DM in our report rather than operative stress. The patient’s skin manifestations didn’t appear until after chemotherapy had started and before all of the cycles had been completed.

A 53-year-old man with enlarged cervical lymph nodes was described by Yu Fujiwara et al. (Japan, 2020), and

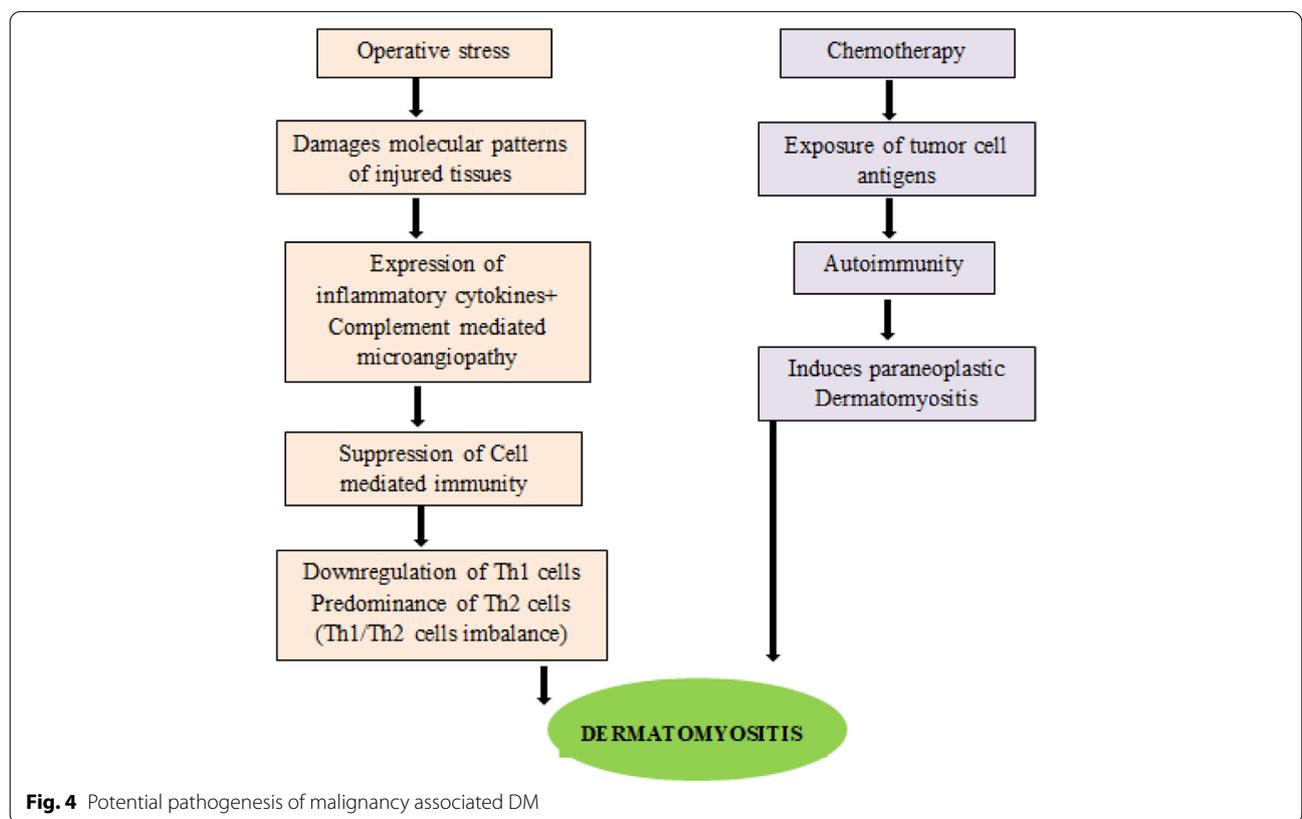
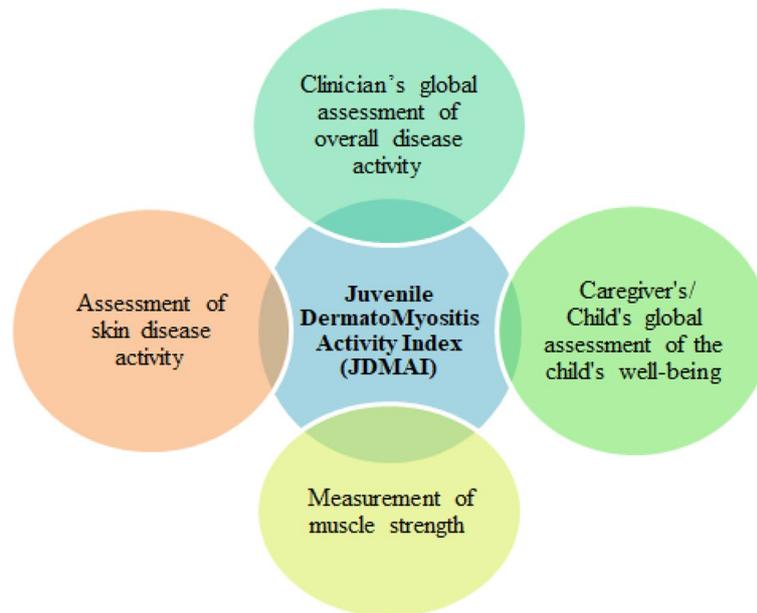


Fig. 4 Potential pathogenesis of malignancy associated DM



**Fig. 5** Evaluation of Response to therapy in JDM

a biopsy revealed embryonal cancer in this case. After one month of treatment with the Bleomycin, Etoposide, and Cisplatin (BEP) regimen, the patient had developed skin lesions of DM [11]. Yuki Otsuka et al. (Japan, 2017) described a case of a 61-year-old woman who had invasive ductal breast cancer and had developed DM [12]. Yuta Ito et al. (Japan, 2017) described a case of an ovarian cancer patient, age 50, who acquired diabetes after undergoing hysterectomy, adnexectomy, and chemotherapy with Paclitaxel and Carboplatin (PTX + CBDCA) [13]. They had hypothesised that cytokines such tumour necrosis factor (TNF)- may be crucial in the development of scleroderma/DM caused by taxanes. After receiving chemotherapy with Carboplatin and Capecitabine, a 76-year-old man with a recent diagnosis of metastatic gastric adenocarcinoma developed diabetes mellitus, according to a case study by Xiaolong et al. (UK, 2014) [14]. A few of the many medications that have a higher degree of correlation with DM are etoposide, carboplatin, paclitaxel, bleomycin, cisplatin and cyclophosphamide. We attribute the development of DM to chemotherapy rather than the malignancy of Retinoblastoma because there is no evidence linking it to the development of DM. Our patient received etoposide and carboplatin for 13 cycles during which time she developed the hall cutaneous manifestations of DM.

Control of the underlying inflammatory myositis and the avoidance or treatment of complications are the objectives of treatment (Contractures and Calcinosi) [15]. Photoprotection, anti-pruritic medications,

topical corticosteroids or calcineurin inhibitors, systemic corticosteroids, or methotrexate are all parts of a multifaceted strategy to treating JDM [15]. The first line of treatment for children with mild to severe JDM is a combination of high-dose oral prednisone (2 mg/kg per day) and methotrexate (15 mg/m<sup>2</sup>, once weekly subcutaneous injection) [16]. The cumulative dose of corticosteroids and their negative side effects are decreased by this combination medication [17]. Patients on oral Prednisone therapy may experience a poor response or worsening of their condition; in these cases, intravenous methylprednisolone (IVMP) or intravenous immunoglobulin is added.

The Juvenile Dermatomyositis Activity Index (JDMAI) used a composite score made up of four components to make the evaluation of treatment response simpler (Fig. 5) [18].

Over the course of 6 to 8 weeks of therapy, the effectiveness of the treatment is clinically observed for improved muscle strength and cutaneous symptom alleviation. Typically, a decrease in Creatine kinase levels is first observed throughout the healing process, followed by a more gradual return of muscle strength. The prednisone dose can be reduced once clinical improvement is seen [18]. In connecting the patient's history with clinical indicators, our case study emphasises the importance of clinical judgement. A multidisciplinary strategy combining family doctors, rheumatologists, dermatologists, and medical oncologists is crucial for the management of JDM.

## Conclusion

To the best of our knowledge, chemotherapy-induced juvenile dermatomyositis is a rare occurrence, in contrast to a number of earlier findings that focused on the temporal relationship between dermatomyositis and malignancy. A delayed diagnosis of DM would be detrimental to the patient's survival and quality of life.

## Abbreviations

JDM: Juvenile Dermatomyositis; ANA: Anti-nuclear antibodies; LDH: Lactate Dehydrogenase; CPK: Creatine Phosphokinase; DM: Dermatomyositis; EMG: Electromyography; MRI: Magnetic Resonance Imaging; CK: Creatine Kinase; IVMP: Intravenous Methylprednisolone; JDMAI: Juvenile Dermatomyositis Activity Index.

## Acknowledgements

The Authors thank the parents of the child for their consent in this research to help in teaching and medical education purpose.

## Authors' contributions

KV, CVSA, SM conceptualized, searched the literature and wrote the first draft. AV, ML analysed the data and revised the first draft, JV edited and approved the final draft. All authors agreed mutually to submit for publication.

## Funding

None.

## Availability of data and materials

The datasets analysed during the current study was available from the corresponding author on reasonable request.

## Declarations

### Ethics approval and consent to participate

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient's parents have given their consent for patient's images and other clinical information to be reported in the journal. The patient's parents understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

### Consent for publication

Written informed consent was obtained from the patient's parents for publication of this case report and any accompanying images and videos. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

### Competing interests

The authors declare that they have no competing interests.

Received: 15 February 2022 Accepted: 24 October 2022

Published online: 31 October 2022

## References

1. Oddis CV, Conte CG, Steen VD, Medsger TA Jr. Incidence of polymyositis-dermatomyositis: a 20-year study of hospital diagnosed cases in Allegheny County, PA 1963–1982. *J Rheumatol*. 1990;17(10):1329–34.
2. Olazagasti JM, Baez PJ, Wetter DA, Ernste FC. Cancer risk in dermatomyositis: a meta-analysis of cohort studies. *Am J Clin Dermatol*. 2015;16:89–98.
3. Bottai M, Tjörnlund A, Santoni G, et al. EULAR/ ACR classification criteria for adult and juvenile idiopathic inflammatory myopathies and their major subgroups: a methodology report. *RMD Open*. 2017;3:e000507. <https://doi.org/10.1136/rmdopen-2017-000507>.
4. Bohan A, Peter JB. Polymyositis and Dermatomyositis. *N Engl J Med*. 1975;292:344–7.
5. Hill CL, Zhang Y, Sigurgeirsson B, Pukkala E, Mellemkjaer L, Airio A, et al. Frequency of specific cancer types in dermatomyositis and polymyositis: a population-based study. *Lancet*. 2001;357:96–100.
6. Sontheimer RD. The management of dermatomyositis: current treatment options. *Expert Opin Pharmacother*. 2004;5:1083.
7. Hundley JL, Carroll CL, Lang W, et al. Cutaneous symptoms of dermatomyositis significantly impact patients' quality of life. *J Am Acad Dermatol*. 2006;54:217.
8. Crowe WE, Bove KE, Levinson JE, Hilton PK. Clinical and pathogenetic implications of histopathology in childhood polydermatomyositis. *Arthritis Rheum*. 1982;25:126.
9. Chen FW, Zhou X, Egbert BM, Swetter SM, Sarin KY. Dermatomyositis associated with capecitabine in the setting of malignancy. *J Am Acad Dermatol*. 2014;70:e47–8.
10. Zampieri S, Valente M, Adami N, et al. Polymyositis, dermatomyositis and malignancy: a further intriguing link. *Autoimmun Rev*. 2010;9:449–53.
11. Fujiwara Y, Fukuda N, Ohmoto A, Nakano K, Ono M, Taira S, Torii J, Takamatsu M, Takahashi S. An extragonadal germ cell tumor with dermatomyositis: A case report and literature review. *Mol Clin Oncol*. 2020 Nov;13(5):60. doi: <https://doi.org/10.3892/mco.2020.2130>. Epub 2020 Sep 3. PMID: 32953114; PMCID: PMC7484733.
12. Otsuka Y, Watanabe H, Kano Y, Tatebe N, Sunahori-Watanabe K, Kawabata T, Sada KE, Wada J. Occurrence of Dermatomyositis Immediately after Mastectomy Subsequent to Severe Chemotherapeutic Drug Eruption. *Intern Med*. 2017;56(24):3379–3383. doi: <https://doi.org/10.2169/internalmedicine.9194-17>. Epub 2017 Dec 15. PMID: 29249766; PMCID: PMC5790732.
13. Ito Y, Hamada Y, Katayama K, Uno H, Nakada T. Dermatomyositis associated with docetaxel use in the treatment for ovarian cancer. *Case Rep Clin Med*. 2017;6:281–4. <https://doi.org/10.4236/crcm.2017.610031>.
14. Callen JP. Photosensitivity in collagen vascular diseases. *Semin Cutan Med Surg*. 1999;18:293.
15. Stringer E, Bohnsack J, Bowyer SL, Griffin TA, Huber AM, Lang B, Lindsley CB, Ota S, Pilkington C, Reed AM, Scuccimarrì R. Treatment approaches to juvenile dermatomyositis (JDM) across North America: the childhood arthritis and rheumatology research alliance (CARRA) JDM treatment survey. *J Rheumatol*. 2010;37(9):1953–61.
16. Bowyer SL, Blane CE, Sullivan DB, Cassidy JT. Childhood dermatomyositis: factors predicting functional outcome and development of dystrophic calcification. *J Pediatr*. 1983;103:882.
17. Ramanan AV, Campbell-Webster N, Ota S, et al. The Effectiveness of treating juvenile dermatomyositis with methotrexate and aggressively tapered corticosteroids. *Arthritis Rheumatol*. 2005;52:3570–8.
18. McCann LJ, Juggins AD, Maillard SM, et al. The Juvenile Dermatomyositis National Registry and Repository (UK and Ireland)—clinical characteristics of children recruited within the first 5 yr. *Rheumatology (Oxford)*. 2006;45:1255.

## Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Ready to submit your research? Choose BMC and benefit from:

- fast, convenient online submission
- thorough peer review by experienced researchers in your field
- rapid publication on acceptance
- support for research data, including large and complex data types
- gold Open Access which fosters wider collaboration and increased citations
- maximum visibility for your research: over 100M website views per year

At BMC, research is always in progress.

Learn more [biomedcentral.com/submissions](https://biomedcentral.com/submissions)

