

## Juvenile Dermatomyositis King Hussein Medical Center Experience

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### Abstract

#### Background:

Juvenile dermatomyositis (JDM) is an uncommon, often chronic, and potentially serious childhood systemic autoimmune vasculopathy affecting primarily skin and muscles. It is characterized by pathognomonic rash, and symmetrical proximal muscle weakness.

#### Objective:

In this retrospective study, we reviewed the clinical, laboratory profiles, treatment and outcome of Jordanian children diagnosed with JDM in the past 8 years in a tertiary facility in Amman, Jordan.

#### Methods:

Sixteen (16) JDM patients, diagnosed based on criteria of Bohan and Peter, and have attended the pediatric rheumatology clinic in King Hussein Medical Center, from January 2006 to September 2013, were recruited. Their medical records were studied for clinical and biochemical profile, radiological and electrophysiological data were studied as well. Treatment and outcome were also reviewed.

#### Results:

Our cohort includes 16 patients, 9(56 %) males, and 7 (44%) females (M: F 1.3:1), their age ranges between 2 to 9 years, with average age at diagnosis of 5.4 years. Time to diagnosis varies from 2 months to 12 months, and averages at 4.6 months. Proximal muscle weakness was present at time of diagnosis in 14(87.5 %) cases. Cutaneous signs in form of either poikiloderma in malar distribution, Gottron's sign and /or heliotrope sign were apparent in all the 16(100%) patients at time of diagnosis, periungual erythema was evident in 10(63%) patients while abnormal nailbed capillaries pattern was only reported in 6(38%) cases.

Skin and soft tissue calcification, crusting and ulceration were seen in 3(19 %) patients. Serum Lactate dehydrogenase, (LDH) was elevated in 94% and creatinine phosphokinase (CPK) in 88%. Elevated SGOT (AST) was seen in almost all subjects, while ESR was high in 14 (87.5%) patients. All patients treated with corticosteroids and methotrexate (MTX).

Two (12.5%) patients died in our series, complete remission was achieved in 4(25%) of patients, while partial remission was seen in 8 (50%) of patients in our cohort.

#### Conclusion:

JDM is a rare disease that has the potential to cause physical disability, poor functional outcome, and death if not recognized early and treated properly. We focused in our study, on importance of early referral, and aggressive therapy in improving outcome, aiming to increase awareness of families and general pediatricians.

**Key Words:** Juvenile dermatomyositis, Myopathy, Calcinosis, Heliotrope sign

#### Introduction:

Juvenile dermatomyositis (JDM) is an uncommon, often chronic, and potentially serious childhood systemic autoimmune vasculopathy affecting primarily skin and muscles<sup>[1]</sup>. It is characterized by pathognomonic rash, and symmetrical proximal muscle

weakness<sup>[2]</sup>. JDM age of onset averages at 7 years in most studies, and females outnumber males by at least two folds<sup>[2]</sup>. The disease has an annual incidence in USA and UK, of around 3 per million child<sup>[3]</sup>.

The cutaneous manifestations, which are seen in almost all patients and might be incapacitating, consists mainly of photodermatitis, violaceous purple macules around the eyes, known as

heliotrope sign, and shiny pink to silvery papules over extensor surface of knuckles, elbows and knees, known as Gottron's sign [4]. Skin and soft tissue calcification, crusting and ulceration is seen in up to 40% of affected children, more commonly late in their course [5]. Capillaries are most often abnormal when viewed at nailbed [6]. Lipodystrophy and generalized oedema (Anasarca) may be infrequently found [6].

The majority of children will have evidence of muscle involvement at time of diagnosis, manifested as pelvic girdle and/or neck flexure weakness, muscle enzymes leak, abnormal electromyography (EMG), muscle oedema in magnetic resonance imaging (MRI), or consistent muscle biopsy [6].

Fever, fatigue, anorexia, myalgias and arthralgias are frequent constitutional symptoms reported at time of presentation [7].

Diagnosis is made using the original criteria by Bohan and Peter [6, 7], in subjects below 18 years of age, in whom the cutaneous manifestations are mandatory. The presence of muscle weakness, elevated muscle enzymes, myopathy in EMG, and myositis in biopsy will meet definite JDM criteria, and two of them are enough for probable diagnosis, while only one criterion will put the patient in the rank of possible JDM [7].

Besides muscular and cutaneous disease, several organs might be involved, rarely few patients develop pulmonary involvement of interstitial lung disease that carry poor prognosis. Significantly persistent or severe abdominal pain could be troublesome and reflects vasculitis of gastrointestinal tract that may cause perforation, ulceration and hemorrhage. Dysphagia and esophageal dysmotility might be life threatening [8]. Arthritis and contractures may be seen in up to one third of patients [6, 8]. Cardiac and ophthalmological involvements are rarely encountered [8].

Complex genetic factors may stand behind immune dysfunction and the resulting vasculitic damage, autoimmune mechanism is evident by presence of myositis specific auto antibodies in up to 70% of patients [6, 9].

JDM is a highly morbid condition that can lead to permanent physical disability, and sometimes death, if left untreated. Before the advent of

corticosteroids, mortality reached 30%, and many were left disabled, but mortality now is in the range of 2-3% [10]. It is invariably agreed that early recognition and aggressive treatment, will improve the outcome, and decrease the rate of life threatening complications [11].

In this retrospective study, we reviewed the clinical, laboratory profiles, treatment and outcome of Jordanian children diagnosed with JDM in the past 8 years in a tertiary facility in Amman, Jordan.

### **Patients and methods:**

Sixteen (16) JDM patients, diagnosed based on criteria of Bohan and Peter [6, 7, 11], and have attended the pediatric rheumatology clinic in King Hussein Medical Center, from January 2006 to September 2013, were recruited. Their records were retrospectively studied.

The study was approved by the ethical committee of the Royal Medical Services ahead of collecting data.

General analytical approach for retrospective data was used to retrieve mean or average, percentage and population standard deviation when applicable.

All subjects were fulfilling either probable or definite criteria; patients with amyopathic form of JDM and overlap connective tissue disease were excluded.

Medical records of those patients were reviewed; Gender, age, onset and duration (time to diagnosis), and presenting features were recorded.

Remission was defined as absence of clinical and lab/imaging parameters of disease activity for 6 months or more without any treatment [12], while absence of those parameters for more than three months while on treatment, is considered response or partial remission.

Cutaneous findings and muscular weakness were tracked during the duration of follow up, as well as presence or absence of extramuscular non cutaneous symptoms and signs.

Records were checked for presence or absence of dysphagia, dysphonia, and pulmonary involvement, cardiac, gastrointestinal and joint manifestations.

Laboratory values of muscle enzymes; Creatine phosphokinase (CPK), aspartate aminotransferase (ASAT) and alanine

aminotransferase (ALAT), lactate dehydrogenase (LDH), were recorded and traced.

We also looked at white blood cell (WBC) counts, platelets count, and erythrocyte sedimentation rate (ESR). Antinuclear antibodies (ANA), Anti dsDNA, extractable nuclear antigen (ENA), rheumatoid factor (RF) and urinalysis, were included as well.

Electromyographic (EMG) findings, muscle magnetic resonance imaging (MRI), and muscle histopathological specimens results (if applicable), were reviewed.

We have also studied therapeutic agents that were used, duration of treatment, course, and follow up duration, outcome and complications in each included patient.

### Results:

Our cohort includes 16 patients, 9(56 %) males, and 7 (44%) females (M: F 1.3:1), their age ranges between 2 to 9 years, with average age at diagnosis of 5.4 years. Time to diagnosis varies from 2 months to 12 months, and averages at 4.6 months, as shown in table 1.

Definite diagnosis was made in 2(12.5%), the rest of patients in our series {14 (87.5%)} meet the definition of probable diagnosis.

The mean duration of follow up for the 16 subjects, was 1.5 years ( $1.5 \pm 1.4$ ) years.

Constitutional symptoms of fatigue, malaise and anorexia were present in 7 (44 %) patients,

Whereas fever was reported in only 2(12.5%) patients.

Proximal muscle weakness was present at time of diagnosis in 14(87.5 %) cases, pelvic girdle weakness was seen in all of the 14(100%) patients and neck flexors weakness in 9(64%) of them. Cutaneous signs in form of either poikiloderma in malar distribution, Gottron's sign and /or heliotrope sign were apparent in all the 16(100%) patients at time of diagnosis, figure 2 A, 2 C, periungual erythema was evident in 10(62.5%) patients while abnormal nailbed capillaries pattern was only reported in 6(37.5%) cases. Malar photodermatitis was seen in 10 (63%) patients, while Gottron's sign was present in 12 (75%) patients, and heliotrope sign was reported in 9 (56%) patients.

Skin and soft tissue calcification, crusting and ulceration were seen in 3(19 %) patients, two of

them at presentation and the third one during subsequent follow up, figure 2 B.

One (6%) patient was having generalized oedema (ana sacra) at presentation, and 4 (25%) patients were having joint contracture at time of diagnosis or during their course.

Dysphagia and dysphonia were reported in 3(19%) cases during the disease course, and significant abdominal pain was seen in 6(38%) patients.

Breathing difficulty, cough and hypoxia were seen in 2 (12.5%) cases; pulmonary involvement was evident by interstitial pneumonitis shown on their chest radiography (CXR), figure 2 D, and computed tomography scans (CT). One (6%) of our patients showed cardiac involvement in form of transient sinus bradycardia evident in electrocardiography (ECG), with normal echocardiography. Eye involvement was not seen in any of our cases.

Serum Lactate dehydrogenase, (LDH) was elevated in 94% and creatine phosphokinase (CPK) in 87.5%. Elevated ASAT was seen in almost all subjects, while ESR was high in 14 (87.5%) patients, as seen in table 2.

The mean  $\pm$ SD level of ESR was  $55 \pm 22$  mm/h with a range of 20-90 mm/h, where as the mean  $\pm$ SD level of CPK and LDH were  $895 \pm 668$  IU/l (range 85-2300 IU/l) and  $648 \pm 188$  IU/l (range 390-995 IU/l), respectively. The mean  $\pm$ SD level of ASAT and ALAT were  $234 \pm 123$  IU/l (range 65-465 IU/l) and  $121 \pm 53$  IU/l (range 45-210 IU/l), respectively.

Raised platelets counts were seen in 11 (69 %) patients. Their count was ranging from 315 to  $785 \times 10^3$ , mean  $\pm$ SD ( $532 \pm 130$ )  $\times 10^3$ . Hemoglobin and WBC'S were normal in almost all patients, kidney function and urine analysis were normal as well. Chest X-Ray and chest CT scan were shown abnormal in 2 (12.5%) patients during their disease course, figure 2 D.

Positive ANA or other auto antibodies like extractable nuclear antigen (ENA) was found in 4 (25%) of our patients.

All patients (100%) underwent electromyography (EMG), it was reported to have short duration, low-amplitude, and increased spontaneous activity with fibrillations, and positive sharp waves with early recruitment, highly consistent of a myopathic process, either at presentation or subsequent follow up.

Muscle magnetic resonance imaging (MRI) was done in 9 (56%) patients and it revealed muscle edema in 7(44%) of them, figure 2 E, but muscle biopsy was done in only 2 (12.5%) patients, who showed myositis with dense cellular, mainly lymphocytic, infiltrate, fibrosis and regenerative changes.

As shown in figure 1, Corticosteroids were used in all patients, most of them in form of initial pulses, then oral with gradual tapering, 8(50%) patients were maintained with hydroxychloroquine mainly for skin disease.

Fifteen (94%) patients were maintained with methotrexate (MTX) in a dose of 10 to 15 mg/m<sup>2</sup>/wk or 0.3 to 0.6 mg/kg/wk, while cyclosporine was used as alternative or adjunctive to MTX, in 3 (19%) patients.

Intravenous immunoglobulin (IVIG) was given in a monthly dose of 2g/kg for one, two or three consecutive months, to 4 (25%) cases, in which myopathy was resistant, having recalcitrant calcinosis or life threatening interstitial lung involvement.

Three (19%) patients with refractory muscle weakness, life threatening dysphagia and respiratory disease, were given infliximab, the chimeric monoclonal antibody against the tumor necrosis factor-alpha (TNF $\alpha$ ), and one (6%) patient received rituximab, the chimeric monoclonal antibody against the protein CD20 on B cells, for incapacitating myopathy and widespread calcification.

Pamidronate disodium was used in two (12.5 %) patients with advanced calcifications, and intralesional steroids (triamcinolone or depomedrol) were given to the same two patients.

Complete remission was achieved in 4(25%) of patients, while partial remission was seen in 8 (50%) of patients in our cohort, the mean duration of follow up was 1.5 years ( 3 months to 5 years).

Active disease was still present, in two (12.5%) patients, who have mainly ulcerative vasculitic lesions and clinical or biochemical evidence of myopathy.

Two (12.5%) patients died in our series, one with severe myopathy, and dysphagia who aspirated and suffocated at home 3 months after diagnosis, and the second one died because of respiratory failure complicating interstitial lung

involvement and palatal dysfunction manifested before as dysphagia and dysphonia.

### Discussion:

Juvenile dermatomyositis (JDM) is the most common idiopathic inflammatory myopathy in childhood; it is a rare, often autoimmune and chronic vascular inflammation of mainly muscles and skin [13]. Its cause, to large extent, is still not understood, but thought to be autoimmune inflammation triggered by environmental factor in a genetically susceptible individual [13].

We have described the demographic, clinical and biochemical profile of 16 Jordanian children with Juvenile dermatomyositis (JDM) referred to a tertiary center in Amman.

Our service is the only pediatric rheumatology facility in the country, and to best of our knowledge this is the first report from Jordan that looked into a series of those patients, however, the number in this review does not actually reflect all patients in Jordan as some patients are managed in other hospitals.

We utilized the traditional criteria by Bohan and Peter, for diagnosis, that combine clinical, laboratory, and pathologic features to define both polymyositis (PM) and JDM [6, 7, 11, 14].

We found it difficult to apply and meet criteria for definite diagnosis, as muscle biopsy which is invasive, is needed to definitely diagnose patients according to this criteria, all our patients, instead, undergo the less invasive EMG and MRI of muscles.

Only two (12.5%) patients in our cohort, underwent histopathological confirmation of definite diagnosis by muscle biopsy, this trend is consistent with reports from other centers in which the use of muscle biopsy in the diagnosis of JDM has largely fallen out of favor. The UK and Ireland JDM National Registry and Repository found that only 36% of JDM patients had a muscle biopsy documented, others reported that only 61% of clinicians used muscle biopsy routinely [15].

Even though, we still have lower rate of histopathological confirmation of definite diagnosis, in our series, this might be partially attributable to the invasiveness of the procedure, need for arrangement with surgeon and operative theater, and more importantly lower

yield in young children, due to difficulty sampling the representative tissue.

Age of our patients, seems relatively younger, compared to other reports, the average age of diagnosis in our cohort was 5.4 years, Sallum *et al.* [16], reviewed a series of Brazilian children, in whom mean age was 6 years and 10 months and Stringer *et al.* [17], studied Canadian children with JDM, and found their age average at 6.8 years .

This earlier age of onset in our patients might explain, partially, the less common finding of male predominance, in our series, where M:F, was found to be 1.3:1, most of other reports indicated female predominance [16,17]. A study of Iranian children with JDM showed equal gender ratio (M: F 1:1) [18]. In spite of the fact that the gender difference tends to be less obvious at younger age, our cohort clearly demonstrated the reverse gender predominance, and we don't have enough explanation for this observation.

Time required, after onset, for diagnosis averages at 4.6 months, which seems longer than what was reported in Canadian and Iranian children of about 2.5 months [17, 18].

The mean duration of follow up in our cohort, is relatively short one of 1.5 years (3 months-5years), as we included patients who recently presented to our care in 2013, and two of our children died early in their disease course.

Our data clearly demonstrated the high frequency of skin manifestations, in almost all patients, similar to other reports [8, 13, 15, 16, 17, 18].

At least one cutaneous feature of either, malar photodermatitis, Gottron's papules, or heliotrope sign, or more commonly two or all of them were present at time of diagnosis, in 13 (81%) of our patients, and one patient who had edema developed rash in the subsequent visits, while the remaining two(12.5%) patients were having calcinosis at presentation.

This might be comparable to the findings by Reza Shiari *et al.* [18], in a report of JDM in Iranian children, who showed 71% frequency of skin disease at presentation.

Nailbed capillaries abnormality reflected by either periungual erythema, or abnormal capillaroscopy, was found in 62.5%, 37.5 % of our patients, respectively.

Periungual telangiectasia is a characteristic finding in juvenile DM, this important sign is

inherent to the underlying pathophysiology of small vessel vasculitis, and its frequency was comparable in our cohort, to other reports, Ramanan *et al.* [19], found that 80 % of their patients were having abnormal nailfold capillaries at presentation and earlier study by Miller *et al.* [20], reported 50-100% frequency of this sign.

Moreover, the persistence of periungual erythema or abnormal capillaries viewed at nailbed was found to be associated with ongoing activity and long term damage in JDM patients [21].

The correlation of this finding with the outcome or course wasn't probed, in our series.

Skin ulceration and progressive soft tissue calcification, were found in 2 (12.5%) patients, at presentation, both of them came late after 9 months of disease onset, and they were inappropriately treated with suboptimal dose of oral corticosteroids and low dose methotrexate for long time.

Calcinosis was extensive and difficult to treat in those two children. Localized and limited calcification developed in another child, during his disease course.

The incidence of calcification in our series is about 19%, Bowyer *et al.* [22], reported the same figure, in a cohort of American children with JDM while in another study by Sallum *et al.* [23], done on Brazilian children with JDM, and the frequency of calcification was 43%

It is well recognized, that calcinosis reflects, ongoing inflammation, and associated with delayed recognition and institution of adequate therapy, its presence is also associated with cardiac involvement and heavy immunosuppressive treatment [23]. Of note here, that the only patient in our cohort with cardiac involvement, possibly conductive in nature, as he was having transient and unexplained bradycardia, with normal echocardiography, and only sinus bradycardia shown on ECG and Holter monitor; Was also inflicted by widespread calcification.

Most available reports refer to high frequency of proximal muscle weakness, at presentation or later follow up [6,15,18,19 ,24], we have found that 87.5% of our patients suffer some sort of proximal muscle weakness at time of diagnosis, hip girdle weakness was commoner than neck or

shoulder weakness, and even in the three(19%) patients with absent rash at presentation (two with calcinosis and one with oedema), muscle weakness was evident at time of diagnosis, Clinically, it has been reported that the myopathy often predates the cutaneous manifestations <sup>[19, 24]</sup>.

EMG was performed for all patients in our series(100%), and it was showing myopathic features in 13(81%) of them, while muscle MRI was done for 9 subjects, and reported muscle oedema in 7(44%) patients, and muscle biopsy demonstrated myositis in the two patients, who underwent this procedure, and could fit the definite criteria for diagnosis.

We described serious pulmonary involvement in 2(12.5%) of our patients, who eventually developed respiratory failure and died, both of them were having dysphagia and dysphonia, interstitial lung disease is rare in children with JDM, but is a potential cause of mortality. The development of lung disease is associated with the presence of anti-tRNA synthetase antibodies and other autoantibodies <sup>[24]</sup>, which was not detected in our patients.

Serious gastrointestinal involvement was not seen in our cohort, although significant abdominal pain was reported in 6 patients.

Arthritis or joint contractures may be the presenting manifestations in up to one third of patients; Ravelli *et al.* <sup>[25]</sup>, reported 35% frequency of arthritis four (25%) patients in our cohort showed evidence of joint inflammation.

Muscle enzyme leak was demonstrated in the majority of our patients, CPK, LDH, and ASAT were reported in 87.5%, 94%, and 100 % of our patients, respectively.

Others reported lower prevalence of elevated muscle enzymes, Stringer *et al.* <sup>[26]</sup>, showed frequency between 50 and 85%, with lower mean than in our patients.

We believe that the younger age of onset, and the relatively longer time before the diagnosis, in our study, might be reflected on intensity of inflammation at presentation, where ESR was found normal in only 2(12.5%) patients.

Defined autoantibodies have been identified in up to 40% of juvenile DM patients <sup>[27]</sup>, 4(25%) patients in our cohort were tested positive for either ANA or ENA.

All the 16 patients, in our report, received corticosteroids and MTX, and steroids were in form of pulse methylprednisolone at scheduled intervals, with daily oral intervening dose gradually tapered, such approach, with early introduction of methotrexate have resulted in less corticosteroid toxicity, with apparent ability to reduce oral prednisone more rapidly, decrease the frequency of calcinosis and develop a more rapid response to therapy <sup>[11, 13, 27]</sup>.

Intravenous immunoglobulin (IVIG) was given for 25% in our series, mainly for refractory myopathy, and response was in favor of using this immunomodulatory therapy in moderate to severe JDM, as 3 of them could have improvement of muscle power and decrease in muscle enzymes in the following weeks, with ability to wean off steroids.

For patients with severe myositis, poor prognostic signs or a modest response to initial therapy, intravenous immunoglobulin, cyclosporine and azathioprine, should be considered, based on uncontrolled trials in pediatric patients and several controlled trials in adult idiopathic inflammatory myositis <sup>[6, 11, 27]</sup>.

We had added cyclosporine to three of our patients who failed to respond to conventional steroids and MTX, but azathioprine was not tried in our experience.

High levels of TNF $\alpha$  have been reported in JDM patients with a long disease course suggesting that it may play a significant role in refractory disease <sup>[28]</sup>, and on these bases and for refractory nature of disease course, mainly unremitting myopathy, we gave infliximab, to 3(19%) cases in our cohort, in whom remarkable response was noted in muscle weakness, joint contracture but less prominent effect on skin disease and calcinosis. Rely *et al.* <sup>[28]</sup>, demonstrated major clinical improvement in his small series of 5 children treated with infliximab.

One patient in our series, received anti B cell therapy with rituximab, for long standing disease complicated by progressive calcification, but his skin disease activity and calcinosis, failed to show satisfactory response to this kind of therapy.

Cooper *et al.* <sup>[29]</sup>, studied the response to rituximab in 4 pediatric patients, and his conclusion was encouraging to use it but we thought that the poor response in our patient was

because of late presentation and development of recalcitrant calcinosis resistant to treatment.

Treatment of calcinosis in JDM still poses a great challenge to physicians, as it profoundly compromise patient's life and adds to functional disability threatening those inflicted patients<sup>[30]</sup>. We had included three (19%) patients with calcinosis in our series, in 2 of them, the calcification was widespread and well established, due to late recognition and or inadequate treatment, in the other one patient, calcification was limited and localized.

We have combined sodium pamidronate, intralesional steroids, for those two patients, with some improvement, softening and decreased ulcerations, but one of them needed addition of infliximab for concomitant myopathy, besides other conventional treatment. Previous reports indicated the potential benefit of combating calcification with such regimen<sup>[30]</sup>.

Mortality was relatively higher in our cohort, as two (12.5%) patients died, one of them death might have been preventable, because he choked and aspirated while at home, the other one course was progressive severe and resistant myopathy, with lung involvement and possibly infection (because of lack of typical symptoms and signs of infection in the setting of heavy immunosuppression, overlap between original disease lung involvement and infection and failure to recover a causative microorganism), that ended in grave outcome.

Before the era of corticosteroids, mortality was observed in up to 33% of children with juvenile DM, while another 33% were left with permanent disabilities<sup>[31]</sup>. Since then, mortality in children has decreased to less than 2%<sup>[31]</sup>.

Relatively younger patients, and late referral, in our subjects resulted in prolonged time before diagnosis could be made and late commencement of aggressive treatment that could have prevented complications and improved outcome.

Poor prognostic indicators in juvenile dermatomyositis are late onset of treatment, inadequate initial treatment, recalcitrant disease and pharyngeal involvement<sup>[32]</sup>.

Limitations in our study include: relatively small number of patients, and short period of follow up.

### Conclusion:

JDM is a rare disease that has the potential to cause physical disability, poor functional outcome, and death if not recognized early and treated properly. We focused in our study, on importance of early referral, and aggressive therapy in improving outcome, aiming to increase awareness of families and general pediatricians.

### References:

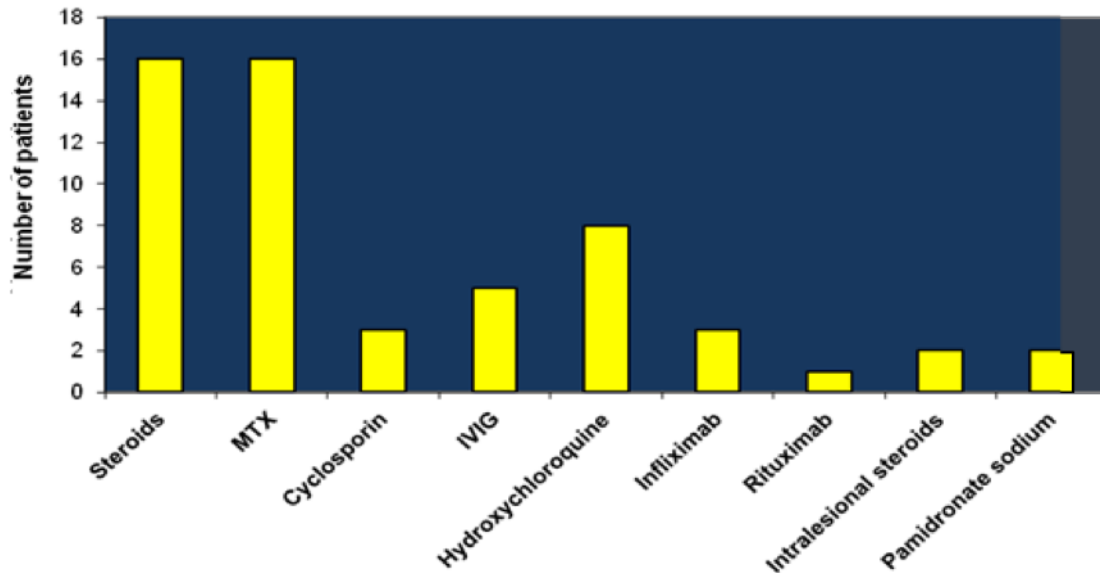
1. **A M. Reed, and M Lopez (2002):** Juvenile Dermatomyositis Recognition and Treatment. *Pediatr Drugs*, 4 (5): 315-32.
2. **A Ravelli, N Ruperto, L Trail, E Felici, E Sala and A Martini (2006):** Clinical assessment in juvenile dermatomyositis. *Autoimmunity*, 39(3): 197–203.
3. **A Ravelli, L Trail, C Ferrari, N Ruperto, A Pistorio, C Pilkington, et al (2010):** Long-Term Outcome and Prognostic Factors of Juvenile Dermatomyositis: A Multinational, Multicenter Study of 490 Patients. *Arthritis Care & Research*, 62(1): 63–72.
4. **Luciano J. Iorizzo III, and Joseph L. Jorizzo (2008):** The treatment and prognosis of dermatomyositis: An updated review. *J Am Acad Dermatol*, 59(1): 99-112.
5. **G Chari, and T A. Laude (2000):** Juvenile Dermatomyositis: A Review. *International Pediatrics*, 15(1):21-25
6. **B M. Feldman, L G. Rider, A M. Reed, and L M. Pachman (2008):** Juvenile dermatomyositis and other idiopathic inflammatory myopathies of childhood. *Lancet* 371: 2201–12.
7. **N S. Rosa Neto and C Goldenstein-Schainberg (2010):** Juvenile dermatomyositis: review and update of the pathogenesis and treatment. *Bras J Rheumatol* 50(3):299-312.
8. **C A. Lowry and C A. Pilkington (2009):** Juvenile dermatomyositis: extramuscular manifestations and Their management. *Current Opinion in Rheumatology* 21:575–580.
9. **N Martin, C K. Li and L R. Wedderburn (2012):** Juvenile dermatomyositis: new insights and new treatment strategies. *Ther Adv Musculoskel Dis* 4(1): 41–50.
10. **A Huber, and B M. Feldman (2005):** Long-term Outcomes in Juvenile Dermatomyositis: How Did We Get Here and Where Are We Going? *Current Rheumatology Reports* 7:441–446.

11. **L R. Wedderburn and Lisa G. Rider (2009):** Juvenile dermatomyositis: new developments in Pathogenesis, assessment and treatment. *Best Practice & Research Clinical Rheumatology* 23: 665–678.
12. **A Patwardhan, R Rennebohm, I Dvorchik and Charles H Spencer (2012):** Is juvenile DM a different disease in children up to three years of age at onset than in children above three years at onset? A retrospective review of 23 years of a single center's experience. *Pediatric Rheumatology* 10:34.
13. **M Batthish and B M. Feldman (2011):** Juvenile Dermatomyositis, *Curr Rheumatol Rep* 13:216–224.
14. **S Khan, and L Christopher-Stine (2011):** Polymyositis, Dermatomyositis, and Autoimmune Necrotizing Myopathy: Clinical Features. *Rheum Dis Clin N Am* 37: 143–158.
15. **L J. McCann, A D. Juggins, S M. Maillard, L R. Wedderburn, J E. Davidson, K J. Murray et al ( 2006):** The Juvenile Dermatomyositis National Registry and Repository (UK and Ireland)-clinical characteristics of children recruited within the first 5 yr. *Rheumatology* 45:1255–1260.
16. **A M. E. Sallum, M H. B. Kiss, S Sachetti, M B. D. Resende, K C. Moutinho, M D. S. Carvalho, et al (2002):** Juvenile Dermatomyositis: Clinical, laboratorial, histological, therapeutical and Evolutive parameters of 35 patients. *Arq Neuropsiquiatr* 60(4):889-899.
17. **E Stringer, D Singh-Grewal, and B M. Feldman (2008):** Predicting the Course of Juvenile Dermatomyositis Significance of Early Clinical and Laboratory Features. *ARTHRITIS & RHEUMATISM*, 58(11): 3585–3592.
18. **R Shiari, A Kiumarsi, F A. Eshgh, and M M.Allameh (2012):** Juvenile Dermatomyositis in Iranian Children; a Case Series Report. *Ann Paediatr Rheum* 1: 58-64.
19. **AV. Ramanan, and B M. Feldman (2002):** Clinical outcomes in juvenile dermatomyositis. *Curr Opin Rheumatol* 14:658–662.
20. **F W. Miller, L G. Rider, Y L. Chung, R Cooper, K Danko, V Farewell, et al (2001):** Proposed preliminary core set measures for disease outcome assessment in adult and juvenile inflammatory myopathy. *Rheumatology* 40: 1262-1273.
21. **S Christen-Zaech, R Seshadri, J Sundberg, A S. Paller, and L M. Pachman (2008):** Persistent Association of Nailfold Capillaroscopy Changes and Skin Involvement Over Thirty-Six Months With Duration of Untreated Disease in Patients With Juvenile Dermatomyositis. *ARTHRITIS & RHEUMATISM*, 58(2): 571–576.
22. **S L. Bowyer, C E. Blane, D B. Sullivan, J T. Cassidy(1983):** Childhood dermatomyositis: Factors predicting functional outcome and development of dystrophic calcification. *J Pediatr*. 103(6):882-8.
23. **A M. E. Sallum, F C. M. M. Pivato, U Doria-Filho, N E. Aikawa, B L. Liphaus, S K. N. Marie, et al (2008):** Risk factors associated with calcinosis of juvenile dermatomyositis. *J Pediatr (Rio J)* 84 (1):68-74.
24. **A M. Huber (2012):** Idiopathic Inflammatory Myopathies in Childhood: Current Concepts. *Pediatr Clin N Am* 59:365–380.
25. **A Ravelli, L Trail, C Ferrari, N Ruperto, A Pistorio, C Pilkington,et al (2010):** Long-Term Outcome and Prognostic Factors of Juvenile Dermatomyositis: A Multinational, Multicenter Study of 490 Patients. *Arthritis Care & Research* 62 (1): 63–72.
26. **E Stringer, D Singh-Grewal, and B M. Feldman (2008):** Predicting the Course of Juvenile Dermatomyositis: Significance of Early Clinical and Laboratory Features. *ARTHRITIS & RHEUMATISM* 58(11): 3585–3592.
27. **L G. Rider (2007):** The heterogeneity of juvenile myositis. *Autoimmunity Reviews* 6: 241–247.
28. **P Riley, L J. McCann, S M. Maillard, P Wool, K J. Murray, and C A. Pilkington (2008):** Effectiveness of infliximab in the treatment of refractory juvenile dermatomyositis with calcinosis. *Rheumatology* 47:877–880.
29. **M A. Cooper, D L. Willingham, D E. Brown, A R. French, F F. Shih, and A J. White (2007):** Rituximab for the Treatment of Juvenile Dermatomyositis A Report of Four Pediatric Patients. *ARTHRITIS & RHEUMATISM* 56(9):3107–3111.
30. **S K. Shinjo, and F H. C. de Souza (2013):** Update on the treatment of calcinosis in dermatomyositis. *REV BRAS REUMATOL* 53(2): 211 – 214.
31. **A M. Huber, E H. Giannini, S L. Bowyer, S Kim, B Lang, C B. Lindsley, et al (2010):** Protocols for the Initial Treatment of Moderately Severe Juvenile Dermatomyositis: Results of a Children's Arthritis and Rheumatology Research Alliance Consensus Conference. *Arthritis Care & Research* 62(2): 219–225.
32. **S Ishaque, S Ahmed, R Ali, and K Minhas (2011):** Juvenile dermatomyositis. *Journal of the College of Physicians and Surgeons Pakistan*, 21(7): 434-436.



	Age/years	Time to diagnosis/months	Gender	Duration of follow up/ years	Presenting complaint
Patient 1	2	3	M	5	Rash and muscle weakness
Patient 2	8	10	M	1.5	Calcinosis and weakness
Patient 3	8	6	F	1	Fatigue and Rash
Patient 4	9	9	M	1	Calcinosis and weakness
Patient 5	8	5	F	5	Fever, rash and weakness
Patient 6	7	5	M	1	Rash and muscle weakness
Patient 7	5	4	M	1	Oedema, fever, weakness
Patient 8	6	4	M	1	Fatigue, malaise and rash
Patient 9	2	2	F	2	Rash and muscle weakness
Patient 10	4	3	M	2	Rash and muscle weakness
Patient 11	3	2	F	0.5	Rash and muscle weakness
Patient 12	4	4	F	1	Fatigue, myalgias and rash
Patient 13	5	6	M	0.5	Rash and muscle weakness
Patient 14	6	5	F	0.25	Fatigue, myalgias and rash
Patient 15	7	3	M	0.5	Rash, Joint contracture
Patient 16	3	3	M	1	Myalgias, Fatigue and rash
Mean	5.4375	4.625	M:F 1.3:1	1.515625	

**Table 1:** Demographic data of Jordanian children with JDM



**Figure 1:** Treatment used in Jordanian children with JDM

## Juvenile Dermatomyositis

Patients	CPK	LDH	AST	ALT	ESR	Platelets	Autoantibodies
1	1200	760	280	195	85	785	ANA 1/160
2	260	490	120	55	35	520	Negative
3	450	600	130	95	40	420	Negative
4	1740	875	310	145	65	610	Negative
5	2300	995	465	210	90	710	Positive ENA
6	1950	815	460	190	75	590	Negative
7	1345	910	355	170	75	680	Negative
8	1135	685	240	130	72	420	Negative
9	570	450	155	95	44	355	ANA 1/320
10	915	765	285	145	60	495	Negative
11	490	455	215	120	65	445	Negative
12	85	390	65	45	20	315	Negative
13	110	470	90	55	22	510	Negative
14	330	495	125	70	31	550	ANA 1/80
15	815	665	275	130	55	630	Negative
16	630	545	170	85	46	480	Negative
Mean	895.3125	647.8125	233.75	120.9375	55	532.1875	–
SD	668.01564 04	188.387621 2	123.010839 6	52.6693696 6	21.8418558 4	129.807148 6	–

**Table 2:** Laboratory and biochemical profile of the Jordanian children with JDM



**Figure 2** : Gottron's sign seen over knuckles and knees **2 A**, extensive skin and soft tissue calcification seen over trunk and in the chest X-ray **2 B**, Heliotrope sign **2 C**, chest X-ray showing bilateral diffuse reticuloendothelial dense infiltration of both lung fields suggestive of interstitial pneumonitis **2 D** , T-weighted muscle MRI showing enhancement and fluid signal in pelvic girdle muscles **2 E** .