Clin Rheumatol (2007) 26:1445–1451
DOI 10.1007/s10067-006-0525-6

ORIGINAL ARTICLE

Eosinophilic fasciitis: report of two cases and a systematic review of the literature dealing with clinical variables that predict outcome

Yukie Endo · Atsushi Tamura · Youichiro Matsushima · Tomoko Iwasaki · Michiko Hasegawa · Yayoi Nagai · Osamu Ishikawa

Received: 21 July 2006 / Revised: 21 December 2006 / Accepted: 22 December 2006 / Published online: 8 March 2007

Abstract We reported two patients with refractory eosinophilic fasciitis (EF) and provided a systematic review of the literature to determine the clinical variables associated with prognosis of EF. We enrolled 88 cases, whose clinical characteristics were analyzed by separating the patients into two or three groups based on outcome. The incidence of certain clinical and pathological features differed among the groups. In particular, the incidence of morphea-like skin lesions in patients with refractory fibrosis was significantly higher than in patients without refractory fibrosis (p= 0.003). Patients with morphea-like skin lesions were 1.9 times more likely to develop persistent fibrosis than patients without these lesions (95% confidence intervals, 1.5–2.5). A younger age (under 12 years) at onset was associated with a 1.6 times greater risk of residual fibrosis (95% confidence interval, 1.1–2.2). Trunk involvement was associated with a 1.4 times greater risk of residual fibrosis (95% confidence interval, 1.0–2.0). Histopathologically, the presence of dermal fibrosclerosis was associated with a 1.4 times greater risk of refractory fibrosis (95% confidence interval, 1.0–2.1). We consider these clinical characteristics, notably the presence of morphea-like skin lesions may be an important risk factor for developing residual fibrosis in EF patients.

Keywords Corticosteroid · Eosinophilic fasciitis · Morphea

Y. Endo (✉) · A. Tamura · Y. Matsushima · T. Iwasaki · M. Hasegawa · Y. Nagai · O. Ishikawa
Department of Dermatology,
Gunma University Graduate School of Medicine,
3-39-22 Showa-machi,
Maebashi, Gunma 371-8511, Japan
e-mail: y_endou@bishinkai.or.jp

Introduction

Eosinophilic fasciitis (EF) is an uncommon connective tissue disease characterized by symmetrical swelling, induration, and thickening of the skin and subcutaneous tissue of the distal extremities [1, 2]. Histologically, patients show striking inflammation and thickening of the fascia. EF is generally recognized as being highly steroid-responsive and benign. However, often the response is partial and may require the addition of other agents. Cases with residual symptoms after many months of steroid therapy have been reported [3, 4]. Because of the small number of new cases, adequately controlled studies have not been conducted that deal with therapeutic or prognostic issues [5]. In this study, we describe two patients with EF whose course worsened and who developed a morphea-like skin disorder despite systemic corticosteroid therapy. Additionally, we reviewed the literature focusing on the development of residual fibrosis to determine whether there was a factor that was predictive for outcome in patients treated with systemic corticosteroids.

Case reports

Case 1

A 29-year-old Japanese woman participated in an exercise program in November 1999. Soon thereafter, she noted swelling of her right hand and lower extremities and visited us in January 2000. On physical examination, her right hand and lower extremities were markedly swollen, and the skin was rock-hard and bound down to the underlying tissue. On the right buttock and medial side of both lower

extremities, there were scattered, slightly erythematous, infiltrated plaques. Laboratory studies revealed a slightly increased C-reactive protein (CRP) of 0.3 mg dl^{-1} (normal, <0.1 mg dl^{-1}) and a slight eosinophilia of 521 mm^{-3} (normal, 300–500 mm^{-3}). Quantitative immunoglobulin tests showed an elevated immunoglobulin M (432 mg dl^{-1}; normal, 35–220 mg dl^{-1}). Deep fascial biopsy from the right leg showed a mild dermal fibrosis and fascial thickening, accompanied by an inflammatory infiltration of lymphocytes, plasma cells, and eosinophils, and confirmed the diagnosis of EF. Prednisolone, 20 mg daily, was given. Within 2 months, the eosinophil count returned to normal; however, the patient relapsed when prednisone treatment was tapered. Progressive multiple patchy sclerodermatous skin changes were seen on all four extremities and the trunk (Fig. 1a). Although the patient has continued to take prednisolone 5 mg/day, her symptoms have persisted to the present time.

Case 2

In January 2003, a 68-year-old Japanese woman was admitted to our hospital with a 1-month history of progressive swelling of her upper and lower limbs. On physical examination, her upper and lower extremities showed severe swelling with nonpitting edema. On the right thigh, there were scattered, slightly erythematous, indurated plaques. Laboratory results showed an increased CRP (3.3 mg dl^{-1}), hypergammaglobulinemia (2.34 g dl^{-1}; normal, 0.7–1.6) and an eosinophilia of 1,070 mm^{-3}. An antinuclear antibody test was positive (titer 1:40,960). Post-gadolinium fat-saturated T1-weighted magnetic resonance (MR) images showed fascial enhancement consistent with active inflammation. Histological examination of a deep biopsy taken from the right thigh revealed that the interlobular fibrous septum of the subcutis, particularly in the lower half, was markedly thickened with infiltration of plasma cells, lymphocytes, and a few eosinophils. The clinical and pathological findings were consistent with those of EF. The patient was started on prednisolone (30 mg daily). Although swelling of the extremities rapidly disappeared, sclerodermatous skin changes gradually developed as the dosage of prednisone was tapered. Multiple glossy, slightly erythematous, infiltrated plaques advanced on the right leg (Fig. 1b). The chest X-ray, pulmonary function tests, and a nail-fold capillaroscopic examination were normal. The patient was treated with whole-body psoralen plus ultraviolet A (UVA) photochemotherapy (cumulative UVA dose 97.5 J cm^{-2}), in addition to prednisolone (10 mg/day). The edematous changes of both upper limbs gradually improved; however, the skin thickening and contracture of the legs have persisted.

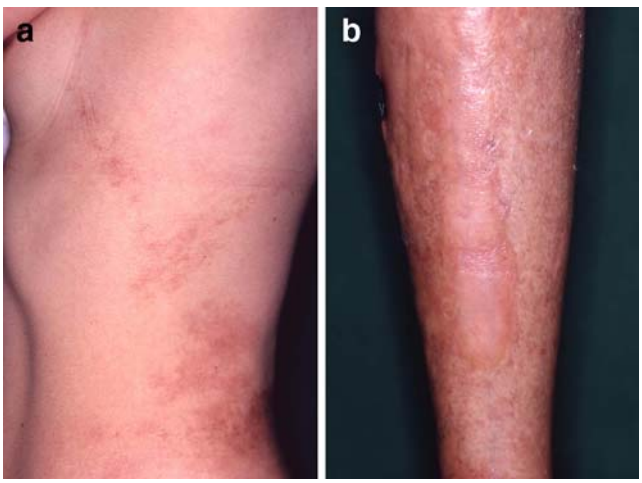

Fig. 1 **a** Brownish indurated plaques on the trunk. **b** Morphea-like plaques on the left leg characterized by waxy and ivory induration surrounded by an erythematous, pigmented lesion

Materials and methods

First, the computerized databases of Medline (1974–2005) and the Cochrane Library (2005, Issue I) were searched for articles with abstracts dealing with EF, Shulman syndrome, diffuse fasciitis with eosinophilia, and diffuse fasciitis with or without eosinophilia. In 1974, Shulman reported the first two cases of EF and described EF as a new syndrome [6]. Relevant articles were selected by means of a title and abstract review. Next, the retrieved cases were assessed to determine if the inclusion and exclusion criteria were met. The inclusion and exclusion criteria are summarized in Table 1. The two patients reported in this paper were included. The clinical outcome of the patients was categorized into three groups based on the response to systemic steroid therapy: (1) cure, (2) remission, (3) and

Table 1 Inclusion and exclusion criteria

Criteria
Inclusion criteria
Case report(s) or review articles published in English
Patient's clinical manifestations and course were available
Patient exhibited characteristic clinical findings: symmetric swelling, induration and/or tightness of the skin and subcutaneous tissues, chiefly affecting the extremities
Patient showed characteristic histopathological findings, including deep fascia, or whose MR imaging revealed inflammation and/or thickening of deep fascia
Patient was treated with systemic corticosteriod
Exclusion criteria
Patient who died during follow-up period
Patient who took L-tryptophan before the onset of the disease
Patient who underwent fasciectomy for the treatment of EF
Patient whose duration of follow-up was shorter than 3 months

persistent. Cases that were free from symptoms at the end of the reported follow-up period were considered cured. Cases that were found to have been improving during the follow-up period and did not have symptoms because of residual fibrosis at the end of the follow-up period were considered to be in remission. Cases that had symptoms because of residual fibrosis at the end of the follow-up period were considered to be persistent. The clinical outcome was independently assessed by two reviewers (Endo and Tamura), and disagreement between the reviewers was resolved by discussion.

Data extracted from the articles included: age, gender, and clinical history (preceding physical stress, disease duration before treatment or diagnosis, clinical and laboratory features, pathological findings, therapy, outcome, and follow-up period). The data were analyzed using chi-square analysis or the Kruskal–Wallis test, as appropriate. A P value of less than 0.05 was considered to indicate statistical significance. Some data were analyzed by separating patients into two groups based on particular characteristics, and the cumulative incidence of persistent cases at the end of the follow-up period was compared between the groups. These cumulative incidence proportions were used to calculate relative risks and the 95% test-based confidence intervals.

Results

A total of 250 cases were reviewed. Eighty-eight cases, including the present two cases, met all the criteria [7–74]. The data were analyzed by separating patients into three groups based on their outcome after systemic steroid therapy: (1) cure [15, 23–25, 27–30, 34, 38, 39, 42, 45, 53, 57, 61, 63, 67–70], (2) remission [14, 21, 27, 31, 34, 55, 56, 64, 66, 71], and (3) persistent [7–13, 15–20, 22, 24, 26, 32, 33, 35–37, 40, 41, 43, 44, 46–52, 54, 55, 57–60, 62, 65, 72–74]. The characteristics of these individuals are described in Table 2. Interestingly, the number of patients with morphea-like skin lesions in the persistent group was significantly greater than that in other groups (p=0.003). Although the difference was not statistically significant, the number of patients with trunk involvement in the persistent group was greater than in the other groups (p=0.154). Some patients were treated with systemic steroid in combination with other drugs, such as immunosuppressive agents. Patients classified into the "cure" group often had favorable outcomes after the addition of oxychloroquine [15], azathioprine [15, 29], potassium para-amino benzoate plus hydrochlorothiazide [24], D-penicillamine [29], cyclophosphamide [34], ibuprofen [45], methotrexate [67], or cyclosporine [69]. On the other hand, no response was seen in patients of the persistent group, despite the addition of aspirin [22], hydroxychloroquine [35, 49], D-penicillamine [37, 49, 59], or methotrexate [54].

Next, we analyzed whether any clinical variables could identify patients at risk of developing intractable sclerosis despite systemic steroid therapy (Table 3). The patients were classified as patients with residual fibrosis (persistent, n=51) and patients without residual fibrosis (cure or remission, n=37) for this analysis. Comparing the number of pediatric patients between the two groups, children under age 12 were found to have a 1.6 times greater risk of developing refractory fibrosis (95% confidence interval,

Table 2 Correlation between clinical characteristics and prognosis

Clinical characteristics	Cure (n=24) Number (%), n/N, or mean±SD	Remission (n=13)	Permanent (n=15)	P value
Age (years)	37.4±15.8	41.2±20.1	37.9±18.6	0.855
Female patients	11(46)	7(54)	27(57)	0.671
Preceding physical stress	10/14	1/5	19/30	0.12
Trunk involvement	3(13)	3(23)	17(33)	0.154
Morphea-like skin lesion	0(0)	1(8)	16(31)	0.003
Peripheral blood eosinophilia	22/23	13/13	47/51	0.525
Total eosinophil count	3,757±7,536 (n=16)	2,120±1,450 (n=12)	1,887±1,344 (n=43)	0.775
Hypergammaglobulinemia or elevated IgG[a]	13/19	5/9	22/31	0.683
Elevated erythrocyte sedimentation rate	17/23	8/12	31/39	0.832
Positive antinuclear antibody	4/18	2/11	10/43	0.937
Tissue eosinophilia	14/20	11/13	36/43	0.405
Dermal fibrosclerosis	3/17	1/8	13/38	0.271
Disease duration before diagnosis or steroid administration[b] (months)	5.1±4.0 (n=18)	7.3±9.5 (n=13)	9.7±24.9 (n=44)	0.893
Follow-up periods (months)	21.6±22.3 (n=22)	18.2±14.8 (n=12)	22.2±30.3 (n=47)	0.94

[a] *IgG* gammaglobulin level
[b] Only in cases whose periods before steroid administration could not be available, periods before diagnosis were used.

Table 3 Relative risk of residual fibrosis according to the clinical features

Clinicopathological features and laboratory data	Patients with residual fibrosis (n=51)	Patients without residual fibrosis (n=37)	Relative risk (95% confidence intervals)
Age (years)			
<12	7	1	1.6 (1.1–2.2)
≥12	44	36	1.0
Female sex			
Yes	29	18	1.1 (0.8–1.7)
No	22	19	1.0
Preceding physical stress			
Yes	19	11	1.0 (0.7–1.8)
No	11	8	1.0
Not reported	21	18	
Involvement of trunk			
Yes	17	6	1.4 (1.0–2.0)
No	34	31	1.0
Morphea-like skin lesion			
Observations described	16	1	1.9 (1.5–2.5)
No observations described	35	36	1.0
Disease duration before diagnosis or steroid administration (months)			
>6	14	9	1.1 (0.7–1.6)
≤6	30	24	1.0
Not reported	7	4	
Peripheral blood epsonophilia			
Yes	47	35	0.7 (0.4–1.2)
No	4	1	1.0
Not reported	0	1	
Hypergammaglobulinemia or elevated IgG[a]			
Yes	22	18	1.2 (0.7–2.0)
No	9	10	1.0
Not reported	20	9	
Elevated erythrocyte sedimentation rate			
Yes	31	25	1.2 (0.7–2.2)
No	8	10	1.0
Not reported	12	2	
Positive antinuclear antibody			
Yes	10	6	1.1 (0.7–1.6)
No	33	23	1.0
Not reported	8	8	
Tissue eosinophilia			
Yes	36	25	1.3 (0.7–2.3)
No	7	8	1.0
Not reported	8	4	
Dermal fibrosclerosis			
Yes	13	4	1.4 (1.0–2.1)
No	25	21	1.0
Not reported	13	12	
Initial dose of prednisone[b]			
≤30	18	17	0.8 (0.5–1.2)
>30	32	17	1.0
Not reported	1	3	
Period of systemic steroid therapy (months)			
>6	29	18	1.1 (0.5–2.1)
≤6	4	3	1.0
Not reported	18	16	

[a] *IgG* gammaglobulin level

[b] In the cases treated with steroids other than prednisone, the doses were converted into prednisone. In the cases whose dose of steroids were described on a weight basis, the doses were calculated as 60 kg body weight.

1.1–2.2). Of the 37 patients with refractory fibrosis, 32 (86%) had involvement of 3–4 extremities or the trunk. Trunk involvement was found to be associated with a 1.4 times greater risk of developing refractory fibrosis (95% confidence intervals, 1.0–2.0). Morphea-like skin lesions were associated with a 1.9 times greater risk of developing residual fibrosis (95% confidence intervals, 1.5–2.5). Histopathologically, the presence of dermal fibrosclerosis was associated with a 1.4 times greater risk of developing residual fibrosis (95% confidence intervals, 1.0–2.1).

Discussion

In agreement with previous studies of pediatric EF patients, we found that a young age at the time of onset may be one of the prognostic factors for refractory fibrosis. Recently, Farrington et al. reported that children under 7 years of age have a two times greater risk of developing residual cutaneous fibrosis (relative risk=2.0 [95% confidence interval, 1.2–3.4]) [50]. In our analysis of EF patients of all ages, we found that 12 years of age was the most significant threshold age value. Pediatric patients have some unique features, such as a female predominance, a higher incidence of hand involvement, and a lower incidence of an associated arthritis or a hematological disorder, both of which are common in adult patients. In addition to the higher risk of developing residual fibrosis, these characteristics may suggest that pediatric EF is a distinct clinical entity [50]. It is unknown why EF in younger patients is corticosteroid-resistant and has an unfavorable outcome. Some data indicate that juvenile fibroblasts have a greater proliferative capacity with high responsiveness to transforming growth factor-beta [75], which is considered to play an important role in the pathogenesis of EF [76]. This may partly explain the high risk of developing residual fibrosis in pediatric patients.

Our study also clarified the prognostic value of trunk involvement and morphea-like skin sclerosis. Skin changes are present on the trunk in only a limited number of patients. In a review of 52 patients with EF, Lakhanpal et al. showed that the abdomen was involved in 12 patients (23%), the chest in nine (17%), the back in three (6%), and the buttocks in three (6%) [4]. In the present study, trunk involvement in patients with refractory fibrosis (33%) was approximately two times as frequent as in patients without residual fibrosis (16%). It would appear that EF with extensive skin involvement tends to advance to severe, corticosteroid-resistant disease. We also found that the frequency of patients who had developed morphea-like skin sclerosis was significantly higher in patient with residual fibrosis (33%) than in patients without residual fibrosis (3%). Histologically, both morphea and EF show homogenization of collagen bundles; however, they are distinguishable by the depth of skin involvement. The lesions of plaque morphea are superficial and affect the dermis or extend into the superficial panniculus. On the other hand, EF is characterized by involvement of subcutaneous tissue and fascia and can occasionally extend into the deep dermis [77]. Morphea-like skin lesions may reflect the progression of inflammation and fibrotic changes to more superficial layers. We consider that a morphea-like skin lesion may be an important prognostic factor for the development of intractable disease.

The mean initial dose of steroids, converted into prednisone (39.7±22.1 mg), and the maximal dose (41.6± 22.2 mg) in patients without residual fibrosis were almost equivalent to those in patients with residual fibrosis (42.2± 18.5 mg and 45.5±24.1 mg, respectively). Although the difference was not statistically significant, the mean disease duration before steroid administration in the persistent group was about two times longer than that in the “cure” group (Table 2). Thus, early therapy rather than intensity of steroid therapy may be associated with a good outcome in EF patients. Some authors have reported on the use of systemic steroid with other agents, but the response to additional drugs has been variable. A favorable outcome, using the combination of corticosteroid–hydroxychloroquine, was reported by Lakhanpal et al. [4]. However, our review of this treatment showed that of the three patients treated, one had a complete remission, one a partial response, and one was unchanged.

EF is characterized by peculiar laboratory abnormalities, such as a peripheral blood eosinophilia, hypergammaglobulinemia, and an elevated erythrocyte sedimentation rate [1]. It has been shown that a correlation between clinical disease activity and laboratory data does not always exist [4]. In the present study, laboratory data were also not associated with prognosis. Histologically, dermal sclerosis was seen more frequently in the patients who developed residual fibrosis. The prognostic value of blood eosinophilia has been noted previously in localized scleroderma, which shares morphologic features with EF [78]. However, neither peripheral nor tissue eosinophilia was associated with the clinical outcome in EF.

The association between EF and a variety of diseases have been reported. Especially, hematologic disease presents a potentially life-threatening association with EF. There is an increased risk of hematologic malignancies associated with EF [79]. In our review, there were ten cases who had hematologic disorder [24, 42, 45–47, 62, 64, 69, 71, 74]. We could not find an association between residual fibrosis and hematologic disorder in the patients with EF.

In conclusion, we reported two patients with refractory EF who developed plaque morphea-like skin sclerosis and reviewed the literature. Our study suggests that a younger

age (under 12 years) at onset, trunk involvement and morphea-like skin sclerosis may be a hallmark of refractory disease. We considered long term physical therapy and follow up are need in those cases.

Acknowledgements This work was supported by the Ministry of Health Welfare Scleroderma Research Committee, Japan.

References

1. Shulman LE (1975) Diffuse fasciitis with eosinophilia. A new syndrome? Trans Assoc Am Physicians 88:70–86
2. Rodnan GP, DiBartolomeo A, Medsger TA Jr, Barnes EL Jr (1975) Eosinophilic fasciitis: report of 7 cases of a newly recognized scleroderma-like syndrome (abstract). Arthritis Rheum 18:422–423
3. Doyle JA, Ginsburg WW (1989) Eosinophilic fasciitis. Med Clin North Am 73:1157–1166
4. Lakhanpal S, Ginsburg WW, Michet CJ, Doyle JA, Moore SB (1988) Eosinophilic fasciitis: clinical spectrum and therapeutic response in 52 cases. Semin Arthritis Rheum 17:221–231
5. Helfman T, Falanga V (1994) Eosinophilic fasciitis. Clin Dermatol 12:449–455
6. Shulman LE (1974) Diffuse fasciitis with eosinophilia. A new syndrome? (abstract). J Rheumatol 1(Suppl 1):46
7. Bennett RM, Herron A, Keogh L (1977) Eosinophilic fasciitis. Case report and review of the literature. Ann Rheum Dis 36:354–359
8. Torres VM, George WM (1977) Diffuse eosinophilic fasciitis. A new syndrome or variant of scleroderma? Arch Dermatol 113:1591–1593
9. Shewmake SW, Lopez DA, McGlamory JC (1978) The Shulman syndrome. Arch Dermatol 114:556–559
10. Weinstein D, Schwartz RA (1978) Eosinophilic fasciitis. Arch Dermatol 114:1047–1049
11. Fu TS, Soltani K, Sorensen LB, Levinson D, Lorincz AL (1978) Eosinophilic fasciitis. JAMA 240:451–453
12. Fleischmajer R, Jacotot AB, Shore S, Binnick SA (1978) Scleroderma, eosinophilia, and diffuse fasciitis. Arch Dermatol 114:1320–1325
13. Chanda JJ, Callen JP, Taylor WB (1978) Diffuse fasciitis with eosinophilia. Arch Dermatol 114:1522–1524
14. Tamura T, Saito Y, Ishikawa H (1979) Diffuse fasciitis with eosinophilia: histological and electron microscopic study. Acta Derm Venereol 59:325–331
15. Nassonova VA, Ivanova MM, Akhnazarova VD, Oskilko TG, Bjelle A, Hofer PA, Henriksson KG, Strom T (1979) Eosinophilic fasciitis. Review and report of six cases. Scand J Rheumatol 8:225–233
16. Keczkes K, Goode JD (1979) The Shulman syndrome: report of a further case. Br J Dermatol 100:381–384
17. Radvan GH, Coombes BH, Francis PN (1979) Diffuse fasciitis with eosinophilia (Shulman's disease). Med J Aust 2:397–399
18. Laso FJ, Aparicio M, Diez-Jarilla JL, Gonzalez-Macias J (1980) A new case of eosinophilic fasciitis. Dermatologica 161:211–216
19. Moutsopoulos HM, Webber BL, Pavlidis NA, Fostiropoulos G, Goules D, Shulman LE (1980) Diffuse fasciitis with eosinophilia. A clinicopathologic study. Am J Med 68:701–709
20. Barraclough D, Begg MW (1980) Diffuse fasciitis with eosinophilia. Aust NZ J Med 10:333–335
21. Kaplinsky N, Revach M, Katz WA (1980) Eosinophilic fasciitis: report of a case with features of connective tissue diseases. J Rheumatol 7:536–540
22. Smiley AM, Husain M, Indenbaum S (1980) Eosinophilic fasciitis in association with thyroid disease: a report of three cases. J Rheumatol 7:871–876
23. Janin-Mercier A, Bourges M, Fonck-Cussac Y, Bussieres JL, Leblanc B, Delage J (1981) Eosinophilic fasciitis. Ultrastructural study of an early biopsied case. Virchows Arch A Pathol Anat Histopathol 394:177–184
24. Kent LT, Cramer SF, Moskowitz RW (1981) Eosinophilic fasciitis: clinical, laboratory, and microscopic considerations. Arthritis Rheum 24:677–683
25. Hines DA, Friedler EM (1981) Eosinophilic fasciitis: an underdiagnosed syndrome. South Med J 74:643–644
26. Thornell LE, Bjelle A (1981) Eosinophilic fasciitis: an ultrastructural and immunohistochemical study of the intermediate filament protein skeletin in regenerating muscle fibres. Neuropathol Appl Neurobiol 7:435–449
27. Lewkonia RM, Marx LH, Atkinson MH (1982) Granulomatosis vasculitis in the syndrome of diffuse fasciitis with eosinophilia. Arch Intern Med 142:73–75
28. Aelion JA, Wysenbeek AJ, Avidor I, Blum I (1982) Eosinophilic fasciitis (Shulman syndrome) with prominent synovitis. Isr J Med Sci 18:793–797
29. Caspi D, Fishel R, Varon M, Yona E, Baratz M, Yaron M (1982) Multisystem presentation of eosinophilic fasciitis. Rheumatol Rehabil 21:218–221
30. Sills EM (1982) Diffuse fasciitis with eosinophilia in childhood. Johns Hopkins Med J 151:203–207
31. Boiesen M, Keiding LM, Thomsen K (1983) Eosinophilic fasciitis. Report of a case with features of other autoimmune disease. Dermatologica 167:142–144
32. Naguwa SM, Robbins DL, Castles JJ (1983) Eosinophilic fasciitis: a distinct clinical entity? Am J Med Sci 286:32–35
33. Patrone NA, Kredich DW (1984) Eosinophilic fasciitis in a child. Am J Dis Child 138:363–365
34. De Jonge-Bok JM, Steven MM, Eulderink F, Cats A (1984) Diffuse (eosinophilic) fasciitis. A series of six cases. Clin Rheumatol 3:365–373
35. Allen SC (1984) Eosinophilic fasciitis in an African-possible benefit of chloroquine treatment. Postgrad Med J 60:685–686
36. Jacobs MB (1985) Eosinophilic fasciitis, reactive hepatitis, and splenomegaly. Arch Intern Med 145:162–163
37. Frayha RA, Atiyah F, Karam P, Ali Ahmed Z, Salman SM (1985) Eosinophilic fasciitis terminating as progressive systemic sclerosis in a child. Dermatologica 171:291–294
38. Sartor O, Sander GE (1985) Unusual variant of eosinophilic fasciitis. South Med J 78:1387–1389
39. Jones HR Jr, Beetham WP Jr, Silverman ML, Margles SW (1986) Eosinophilic fasciitis and the carpal tunnel syndrome. J Neurol Neurosurg Psychiatry 49:324–327
40. Williams HJ, Ziter FA, Banta CA (1986) Childhood eosinophilic fasciitis—progression to linear scleroderma. J Rheumatol 13:961–962
41. Thomson GT, MacDougall B, Watson PH, Chalmers IM (1989) Eosinophilic fasciitis in a pair of siblings. Arthritis Rheum 32:96–99
42. Pressly TA, Treadwell EL, Ansbacher LE, Winkler A, Hoyt TD, Walker SE (1989) Eosinophilic fasciitis with porphyria cutanea tarda and progressive destructive arthritis. J Rheumatol 16:390–393
43. Amdur HS, Levin RE (1989) Eosinophilic fasciitis during pregnancy. Obstet Gynecol 73:843–847
44. Falanga V, Soter NA, Kerdel FA (1989) Increased plasma histamine level in eosinophilic fasciitis. Arch Dermatol 125:805–808
45. Markusse HM, Breedveld FC (1989) Rheumatoid arthritis with eosinophilic fasciitis and pure red cell aplasia. J Rheumatol 16:1383–1384
46. Markusse HM, Dijkmans BA, Fibbe WE (1990) Eosinophilic fasciitis after allogeneic bone marrow transplantation. J Rheumatol 17:692–694

47. Chan LS, Hanson CA, Cooper KD (1991) Concurrent eosinophilic fasciitis and cutaneous T-cell lymphoma. Eosinophilic fasciitis as a paraneoplastic syndrome of T-cell malignant neoplasms? Arch Dermatol 127:862–865
48. Loeliger AE, van den Brink HR, Derksen RH, Bijlsma JW (1991) Eosinophilic fasciitis presenting with a reactive hepatitis. Clin Rheumatol 10:440–444
49. Ching DW, Leibowitz MR (1992) Ketotifen—a therapeutic agent of eosinophilic fasciitis? J Intern Med 231:555–559
50. Farrington ML, Haas JE, Nazar-Stewart V, Mellins ED (1993) Eosinophilic fasciitis in children frequently progresses to scleroderma-like cutaneous fibrosis. J Rheumatol 20:128–132
51. Wong AL, Anderson-Wilms N, Mortensen SE, Colburn KK (1993) Eosinophilic fasciitis in association with chronic vasculitic-like leg ulcerations. Clin Rheumatol 12:85–88
52. Castanet J, Lacour JP, Perrin C, Taillan B, Dubois D, Ortonne JP (1994) Association of eosinophilic fasciitis, multiple morphea and antiphospholipid antibody. Dermatology 189:304–307
53. Watts RA, Merry P (1994) Familial eosinophilic fasciitis and breast cancer. Br J Rheumatol 33:93–94
54. O'Laughlin TJ, Klima RR, Kenney DE (1994) Rehabilitation of eosinophilic fasciitis. A case report. Am J Phys Med Rehabil 73:286–292
55. al-Shaikh A, Freeman C, Avruch L, McKendry RJ (1994) Use of magnetic resonance imaging in diagnosing eosinophilic fasciitis. Report of two cases. Arthritis Rheum 37:1602–1608
56. Takeda S, Takazakura E, Fukui Y (1995) Tubulointerstitial nephritis in a patient with eosinophilic fasciitis and IgA nephropathy. Nephron 69:314–317
57. Fujimoto M, Sato S, Ihn H, Kikuchi K, Yamada N, Takehara K (1995) Serum aldolase level is a useful indicator of disease activity in eosinophilic fasciitis. J Rheumatol 22:563–565
58. Ferlazzo B, Quattrocchi P, Carretti C, La Rosa G, Barresi G (1995) Eosinophilic fasciitis: report of a case diagnosed 14 years after its onset. Minerva Med 86:495–498
59. Stork J, Nemcova D, Hoza J, Kodetova D (1996) Eosinophilic fasciitis in an adolescent girl with lymphadenopathy and vitiligo-like and linear scleroderma-like changes. A case report. Clin Exp Rheumatol 14:337–341
60. Nakajima H, Fujiwara S, Shinoda K, Ohsawa N (1997) Magnetic resonance imaging and serum aldolase concentration in eosinophilic fasciitis. Intern Med 36:654–656
61. Moriguchi M, Terai C, Kuroki S, Tanaka E, Someya N, Tsunoda Y, Kashiwazaki S (1998) Eosinophilic fasciitis complicated with peripheral polyneuropathy. Intern Med 37:417–420
62. Naschitz JE, Misselevich I, Rosner I, Yeshurun D, Weiner P, Amar M, Amato L, Ciompi ML, Boss JH (1999) Lymph-node-based malignant lymphoma and reactive lymphadenopathy in eosinophilic fasciitis. Am J Med Sci 318:343–349
63. Killen JW, Swift GL, White RJ (2000) Eosinophilic fasciitis with pulmonary and pleural involvement. Postgrad Med J 76:36–37
64. Kim H, Kim MO, Ahn MJ, Lee YY, Jung TJ, Choi IY, Kim IS, Park CK (2000) Eosinophilic fasciitis preceding relapse of peripheral T-cell lymphoma. J Korean Med Sci 15:346–350
65. Huemer M, Seeber A, Huemer C (2000) Scleroderma-like syndrome in a child: eosinophilic fasciitis or scleredema adultorum? Eur J Pediatr 159:520–522
66. Vannucci P, Gaeta P, Riccioni N (2001) Association of eosinophilic fasciitis and epileptic seizure. Clin Rheumatol 20:223–224
67. Mosconi S, Streit M, Bronimann M, Braathen LR (2002) Eosinophilic fasciitis (Shulman syndrome). Dermatology 205: 204–206
68. Liou CH, Huang GS, Taylor JA, Juan CJ, Gao HW, Chen CY (2003) Eosinophilic fasciitis in a military recruit: MRI evaluation with clinical correlation. Skelet Radiol 32:52–57
69. Chaudhary UB, Eberwine SF, Hege KM (2004) Acquired amegakaryocytic thrombocytopenia purpura and eosinophilic fasciitis: a long relapsing and remitting course. Am J Hematol 75:146–150
70. Chan V, Soans B, Mathers D (2004) Ultrasound and magnetic resonance imaging features in a patient with eosinophilic fasciitis. Australas Radiol 48:414–417
71. Ustun C, Ho G Jr (2004) Eosinophilic fasciitis after allogeneic stem cell transplantation: a case report and review of the literature. Leuk Lymphoma 45:1707–1709
72. Bukiej A, Dropinski J, Dyduch G, Szczeklik A (2005) Eosinophilic fasciitis successfully treated with cyclosporine. Clin Rheumatol 24:634–636
73. Carneiro S, Brotas A, Lamy F, Lisboa F, Lago E, Azulay D, Cuzzi T, Ramos-e-Silva M (2005) Eosinophilic fasciitis (Shulman syndrome). Cutis 75:228–232
74. Schaffer JV, McNiff JM, Seropian S, Cooper DL, Bolognia JL (2005) Lichen sclerosus and eosinophilic fasciitis as manifestations of chronic graft-versus-host disease: expanding the sclerodermoid spectrum. J Am Acad Dermatol 53:591–601
75. Wu L, Xia YP, Roth SI, Gruskin E, Mustoe TA (1999) Transforming growth factor-beta1 fails to stimulate wound healing and impairs its signal transduction in an aged ischemic ulcer model: importance of oxygen and age. Am J Pathol 154:301–309
76. Kahari L, Jimenez SA (1996) Increased expression of transforming growth factor-beta1, fibronectin, and Types I, III, and VI collagen genes in fascial fibroblasts from patients with diffuse fasciitis with eosinophilia. J Rheumatol 23:482–486
77. Barnes L, Rodnan GP, Medsger TA, Short D (1979) Eosinophilic fasciitis. A pathologic study of twenty cases. Am J Pathol 96:493–517
78. Falanga V, Medsger TA Jr (1987) Frequency, levels, and significance of blood eosinophilia in systemic sclerosis, localized scleroderma, and eosinophilic fasciitis. J Am Acad Dermatol 17:648–656
79. Naschitz JE, Yeshurun D, Zuckerman E, Rosenbaum M, Misselevitch I, Shajrawi I, Boss JH (1994) Cancer-associated fasciitis panniculitis. Cancer 73:231–235