Pediatric Dermatology 1–5, 2013

Clinical Manifestations of Pediatric Psoriasis: Results of a Multicenter Study in the United States

Katherine Mercy, M.D.,* Mary Kwasny, Sc.D.,* Kelly M. Cordoro, M.D.,† Alan Menter, M.D.,‡ Wynnis L. Tom, M.D.,¶ Neil Korman, M.D., Ph.D.,# Leah Belazarian, M.D., April W. Armstrong, M.D., M.P.H.,†† Moise L. Levy, M.D.,‡‡ and Amy S. Paller, M.D., M.S.***

**Department of Dermatology, Northwestern University, Chicago, Illinois, †University of California at San Francisco, San Francisco, California, ‡Baylor Research Institute, Dallas, Texas, ¶University of California at San Diego, San Francisco, California, #University Hospitals Case Medical Center, Cleveland, Ohio, **University of Massachusetts, Worcester, Massachusetts, ††University of California Davis Health System, Sacramento, California, ‡‡Dell Children's Medical Center, Austin, Texas*

Abstract: **The clinical features of pediatric psoriasis warrant further attention. A national study was conducted to determine the prevalence of scalp and nail involvement and a history of guttate psoriasis at onset according to age, sex, and disease severity. One hundred eighty-one children ages 5 to 17 years with plaque psoriasis were enrolled in a multicenter, cross-sectional study. Subjects and guardians were asked about a history of scalp and nail involvement and whether the initial presentation was guttate. Peak psoriasis severity was assessed and defined historically as mild psoriasis (MP) or severe psoriasis (SP) according to the Physician's Global Assessment and body surface area measures. One hundred forty-three (79.0%) subjects reported a history of scalp involvement, and 71 (39.2%) described a history of nail involvement. Boys were less likely than girls to report a history of scalp involvement (odds ratio [OR] = 0.40, 95% confidence interval [CI] = 0.19–0.84) but more likely to have had nail involvement (OR = 3.01, 95% CI = 1.62–5.60). Scalp and nail involvement was not related to psoriasis severity. In contrast, subjects with SP (35.9%) more often reported a history of guttate lesions than did those with MP (21.8%) (p = .02). Antecedent streptococcal infection was more common in children with guttate than those with plaque psoriasis at onset (p = .02) but did not correlate with severity. Sex-related differences in scalp and nail involvement suggest koebnerization. Preceding streptococcal infection predicts guttate morphology but not severity, and initial guttate morphology is associated with eventual greater severity of disease. More aggressive monitoring and management should be considered for guttate psoriasis, given its later association with more severe disease.**

Address correspondence to Amy S. Paller, M.D., Department of Dermatology, 676 N. St. Clair, Suite 1600, Chicago, IL 60611, or e-mail: apaller@northwestern.edu.

DOI: 10.1111/pde.12072

Psoriasis is a chronic, inflammatory skin condition that most commonly presents as the plaque subtype in adults and children (1–3). Few epidemiologic studies have been performed in children with psoriasis (4–10), and these investigations have been regional. These studies have found nail involvement to occur in 17% to 29% (5,9,10) and scalp involvement to be present in 18% to 50% of children with psoriasis (5,8–10). A history of preceding infection and presentation with guttate morphology are features more commonly seen in children than adults with psoriasis (4,7), although the reported percentage of children who initially have guttate psoriasis varies from 6.4% (3) to 44% (6). Although studies in adults have correlated severity and history of arthritis with scalp and nail involvement, similar investigations have never been conducted in children. A multicenter, cross-sectional study was completed to further define the prevalence of associated features of pediatric plaque psoriasis in the United States according to peak disease severity.

MATERIALS AND METHODS

Children with plaque psoriasis were recruited from among all children who presented to eight geographically diverse U.S. dermatology clinics during the study time frame. Children ages 5 to 17 years with a 6-month or longer history of plaque psoriasis, confirmed by a dermatologist, were eligible for enrollment. Each site's institutional review board (IRB) reviewed and approved the study protocol before the completion of any study procedures. Informed consent was obtained from subjects and guardians according to IRB policy at each location. A history of nail and scalp psoriasis and rheumatologist-diagnosed psoriatic arthritis was elicited from subjects. Subjects were also questioned about a family history of psoriasis, preceding streptococcal infection, and initial presentation with a guttate morphology.

Children were classified according to their severity at its worst as having mild (MP) or severe (SP) psoriasis based on historical and, if available, medical record information. Severity was based on the Physician's Global Assessment (PGA) (11) and affected body surface area (BSA). PGA was scored as 0 (none) to 5 (severe). In assessing BSA, each patient's palm represented 1% of the total BSA: <5% BSA was designated as mild, 5% to 10% as moderate, and >10% as severe (12). A PGA of 4 to 5 was designated as SP and 1 to 2 as MP. A moderate PGA score of 3 was designated MP if the BSA was 10% or less and SP if the BSA was >10%. Descriptive statistics are presented as counts and percentages for categorical variables, means and standard deviations for continuous data, and medians and interquartile ranges for psoriasis duration. Analysis of variance or the Student *t* test was used for comparisons, with $p < .05$ considered significant. All analyses were run using SAS version 9.2 (SAS Institute, Inc., Cary, NC).

RESULTS

Between June 2009 and December 2011, 181 children with plaque psoriasis were enrolled; no patient with psoriasis refused to enter the study. Of the subjects enrolled, 78 (43.1%) had MP and 103 (56.9%) had SP (Table 1). The female:male ratio was 1.48:1. Subjects with SP were similar to those with MP in sex, age, race, and ethnicity. Subjects with SP more often required treatment with systemic medications (35.9%) or phototherapy (22.1%) than did those with MP (17.9% and 7.7%, respectively) (both $p < .001$).

Scalp involvement occurred at some point in 143 subjects (79.0%) and nail involvement was reported in 71 (39.2%). Scalp involvement was described less often in boys (70%) than in girls (85%; odds ratio [OR] = 0.40, 95% confidence interval [CI] = 0.19–0.84) and was not associated with age ($p = .66$). In contrast, boys more often reported a history of nail involvement (55%) than did girls (29%; OR = 3.01, 95% CI = 1.62–5.60). Nail involvement was not related to age ($p = .72$). Although a greater proportion of subjects with SP (43.7%) than MP (33.3%) had a history of nail involvement, the difference was not significant ($p = .30$). Similarly, scalp involvement was documented in more subjects with SP (82.5%) than MP (74.4%), but the difference was not significant ($p = .09$). Scalp involvement was not associated with nail involvement ($p = .06$); scalp psoriasis was described in 72% of subjects with nail involvement, and 84% without nail involvement had scalp involvement. Psoriatic arthritis was reported overall in 10.5% of subjects, including 12.7% with nail involvement and 9.1% without nail changes ($p = .44$). The risk of having arthritis was not related to age, sex, or severity of the cutaneous psoriasis.

Guttate morphology was reported in the history of almost 30% of patients and occurred more often at the onset in subjects with SP (35.9%) than in those with MP (21.8%) ($p = .02$). Almost one-quarter (22.1%) of all patients noted precipitating streptococcal infection, half of whom presented with guttate psoriasis, making streptococcal infection a more common antecedent of guttate than plaque psoriasis ($p = .02$), although a precipitating streptococcal infection was not more common in patients with SP (23.3%) than in those with

TABLE 1. *Demographic and Clinical Characteristics of Children with Psoriasis*

Characteristic	All children with psoriasis, $N = 181$	MP, $n = 78$	SP, $n = 103$	p for MP versus SP	Boys, $n = 73$	Girls, $n = 108$	p for male versus female
Demographic							
Age, mean ± standard deviation, median (range)	12.6 ± 3.6, 13 (5–18)	12.3 ± 3.6, 13 (5–18)	12.8 ± 3.6, 13 (5–18)	.27	12.5 ± 3.5, 13 (6–18)	12.6 ± 3.7, 13 (5–18)	.90
Male, *n* (%)	73 (40.3)	27 (34.6)	46 (44.7)	.15	—	—	—
Duration of psoriasis, years, median (interquartile range)	5 (2–9)	4 (2–8)	5 (2–9)	.26	5 (3–8)	5 (2–9)	.53
Race, *n* (%)							
White (non-Hispanic)	110 (60.8)	49 (62.8)	61 (59.2)	>.99	48 (65.8)	62 (57.4)	.42
Asian	22 (12.2)	9 (11.5)	13 (12.6)		11 (15.1)	11 (10.2)	
Hispanic	33 (18.2)	14 (18.0)	19 (18.5)		9 (12.3)	24 (22.2)	
Black	9 (5.0)	3 (3.9)	6 (5.8)		3 (4.1)	6 (5.6)	
Other	7 (3.9)	3 (3.9)	4 (3.9)		2 (2.7)	5 (4.6)	
Family history of psoriasis, *n* (%)	93 (51.4)	35 (44.9)	58 (56.3)	.13	41 (56.2)	52 (48.2)	.29
Clinical, *n* (%)							
Preceding streptococcus	40 (22.1)	16 (20.5)	24 (23.3)	.68	18 (24.7)	22 (20.4)	.46
History of guttate lesions	54 (29.8)	17 (21.8)	37 (35.9)	**.02**	16 (21.9)	38 (35.2)	.06
Nail involvement	71 (39.2)	26 (33.3)	45 (43.7)	.30	40 (54.8)	31 (28.7)	**.001**
Scalp involvement	143 (79.0)	58 (74.4)	85 (82.5)	.09	51 (69.9)	92 (85.2)	**.01**
Psoriatic arthritis	19 (10.5)	7 (9.0)	12 (11.7)	.51	5 (6.9)	14 (13.0)	.19
Phototherapy*	40 (22.1)	6 (7.7)	34 (33.0)	**<.001**	20 (28.6)	20 (18.9)	.13
Systemic medications*	65 (35.9)	14 (17.9)	51 (49.5)	**<.001**	30 (42.9)	35 (33.0)	.19

MP, mild psoriasis; SP, severe psoriasis.
Bolded p values are significant ($p < .05$).
*Some patients had used phototherapy and systemic immunosuppressant medications.

MP (20.5%) ($p = .68$). Onset as guttate psoriasis did not have a predilection for age ($p = .34$) or sex ($p = .06$).

A family history of psoriasis was noted in 51.4% of all children, with affected members being first-degree relatives (parents or siblings) in 59.8% of those cases. Having a history of psoriasis in the entire family or in an immediate family member did not correlate with age of onset, severity, sex, subject age, or nail or scalp involvement. Guttate psoriasis at onset was more often observed in children with a positive family history (37.6%) than without a family history of psoriasis (21.6%; $p = .02$), but was not seen more often when restricted to the immediate family ($p = .22$).

DISCUSSION

Using a multicenter study design, we evaluated several specific clinical features of children with psoriasis across the United States according to age, sex, and severity. This study is the first to examine the relationship between nail and scalp involvement and patient sex in children. In contrast to others, we limited our study to school-age children (≥ 5 years) with a diagnosis of plaque psoriasis for at least 6 months.

In our cohort, the percentages of patients with a history of nail or scalp psoriasis exceeded those of previous studies (4,5,7,10). Girls reported scalp involvement significantly more often than boys, whereas boys had nail psoriasis significantly more often than girls. These differences may reflect the Koebner phenomenon in these special sites and suggest the need to customize treatment according to sex. Regardless, the high frequency of nail and scalp involvement and the emotional and physical effect this may have indicates the need to routinely examine and specifically treat these areas. Recent studies in adults have shown a correlation between nail involvement and the severity of skin involvement (13,14). In our pediatric series, involvement of the nails did not correlate significantly with psoriasis severity or age.

A relationship between nail involvement and psoriatic arthritis in adults has been suggested (13,15–17) and has been proposed to result from concurrent enthesopathy of the distal interphalangeal joint and nail matrix (18). Nevertheless, a recent study of 180 adults with psoriasis, of whom 30.6% had psoriatic arthritis, did not find a correlation between arthritis and nail changes (19). Although nail involvement did not correlate with psoriatic arthritis in our pediatric study, only 10.5% of our patients had psoriatic arthritis, limiting the power of our analysis.

Guttate psoriasis often precedes the development of plaque psoriasis in children (20,21), and 29.8% of

our cohort had guttate psoriasis at onset. In our study, no correlation was found between guttate psoriasis at onset and the occurrence of nail or scalp disease, sex, or age, although initial presentation with guttate morphology was the only factor reliably seen more often in subjects with SP than in those with MP and was also associated with a positive family history of psoriasis. A limitation of the present study is that the reported features of psoriasis and severity designation relied on historical information and, when possible, medical records, leading to the risk of recall bias. In addition, we did not gather information to further delineate the course of guttate psoriasis, such as the aggressiveness of treatment or clearance before the onset of plaque-type psoriasis. Further studies should address whether the prognosis is worse for children who present with guttate morphology and whether more aggressive initial therapy may be warranted for those with guttate psoriasis. Our finding that a precipitating streptococcal infection is often observed in children with guttate psoriasis, but is not more common in those who eventually develop SP than in those with MP, concurs with the discovery by Ko et al (21) that preceding upper respiratory infection and a high antistreptolysin O titer were more common in subjects with eventual resolution of guttate psoriasis and not in subjects with progression to plaque psoriasis. Long-term prospective cohort studies are essential to determine the percentage and features of children with guttate psoriasis at onset who do not progress to plaque involvement and to further determine the natural history of children with guttate psoriasis initially who develop persistent plaque-type psoriasis.

CONCLUSION

There are notable sex-related differences in scalp and nail involvement in children with psoriasis that further suggest the importance of koebnerization. Preceding streptococcal infection predicts guttate morphology but not severity. Initial guttate morphology is associated with the eventual severity of disease, suggesting that early, aggressive treatment of guttate psoriasis may mitigate the eventual severity of psoriasis in children.

ACKNOWLEDGMENTS

This study was funded by the International Psoriasis Council (IPC). We thank Christy Langan at IPC for collecting deidentified data and providing it for data analysis at Northwestern University. Dr. Mercy recently completed a research fellowship, funded in part by the National Psoriasis Foundation. During the past 5 years, Dr. Paller served as an investigator without personal compensation for Amgen-Immunex, Astellas, and Leo Pharma and as a consultant with honorarium for Abbott, Amgen-Immunex, Johnson & Johnson, and Leo Pharma. Dr. Menter has received honoraria as a consultant for Abbott, Amgen, Centocor, Eli Lilly, Steifel, and Wyeth; as a speaker for Abbott, Amgen, Centocor, Galderma, and Wyeth; and for providing testimony for Galderma. Dr. Armstrong has served as an investigator and advisor to Amgen, Abbott, & Janssen. Dr. Korman has received honoraria as a consultant for Abbott, Centocor, Eli Lilly, and Pfizer and as a speaker for Abbott and Centocor. Dr. Levy has served as a consultant with honorarium for Galderma, Stiefel/GSK, and Valeant and as an investigator for Pierre-Fabre. Dr. Tom's salary related to inflammatory skin disease research is in part supported by Career Development Award K23AR060274 from the National Institutes of Health, National Institute of Arthritis and Musculoskeletal and Skin Diseases. Drs. Kwasny, Cordoro, and Belazarian have no potential conflicts of interest.

REFERENCES

1. Fan X, Xiao FL, Yang S et al. Childhood psoriasis: a study of 277 patients from China. J Eur Acad Dermatol Venereol 2007;21:762–765.
2. Mallbris L, Larsson P, Bergqvist S et al. Psoriasis phenotype at disease onset: clinical characterization of 400 adult cases. J Invest Dermatol 2005;124:499–504.
3. Morris A, Rogers M, Fischer G et al. Childhood psoriasis: a clinical review of 1262 cases. Pediatr Dermatol 2001;18:188–198.
4. Kumar B, Jain R, Sandhu K et al. Epidemiology of childhood psoriasis: a study of 419 patients from northern India. Int J Dermatol 2004;43:654–658.
5. Kwon HH, Na SJ, Jo SJ et al. Epidemiology and clinical features of pediatric psoriasis in tertiary referral psoriasis clinic. J Dermatol 2012;39:260–264.
6. Nyfors A, Lemholt K. Psoriasis in children. A short review and a survey of 245 cases. Br J Dermatol 1975;92:437–442.
7. Seyhan M, Coskun BK, Saglam H et al. Psoriasis in childhood and adolescence: evaluation of demographic and clinical features. Pediatr Int 2006;48:525–530.
8. Stefanaki C, Lagogianni E, Kontochristopoulos G et al. Psoriasis in children: a retrospective analysis. J Eur Acad Dermatol Venereol 2011;25:417–421.
9. Tollefson MM, Crowson CS, McEvoy MT et al. Incidence of psoriasis in children: a population-based study. J Am Acad Dermatol 2010;62:979–987.
10. Wu Y, Lin Y, Liu HJ et al. Childhood psoriasis: a study of 137 cases from central China. World J Pediatr 2010;6:260–264.

11. Langley RG, Ellis CN. Evaluating psoriasis with Psoriasis Area and Severity Index, Psoriasis Global Assessment, and Lattice System Physician's Global Assessment. J Am Acad Dermatol 2004;51:563–569.
12. Pariser DM, Bagel J, Gelfand JM et al. National Psoriasis Foundation clinical consensus on disease severity. Arch Dermatol 2007;143:239–242.
13. Brazzelli V, Carugno A, Alborghetti A et al. Prevalence, severity and clinical features of psoriasis in fingernails and toenails in adult patients: Italian experience. J Eur Acad Dermatol Venereol 2011;26:1354–1359.
14. Hallaji Z, Babaeijandaghi F, Akbarzadeh M et al. A significant association exists between the severity of nail and skin involvement in psoriasis. J Am Acad Dermatol 2012;66:e12–e13.
15. Williamson L, Dalbeth N, Dockerty JL et al. Extended report: nail disease in psoriatic arthritis—clinically important, potentially treatable and often overlooked. Rheumatology (Oxford) 2004;43:790–794.
16. Ash ZR, Tinazzi I, Gallego CC et al. Psoriasis patients with nail disease have a greater magnitude of underlying systemic subclinical enthesopathy than those with normal nails. Ann Rheum Dis 2012;71:553–556.
17. Wilson FC, Icen M, Crowson CS et al. Incidence and clinical predictors of psoriatic arthritis in patients with psoriasis: a population-based study. Arthritis Rheum 2009;61:233–239.
18. Tan AL, Benjamin M, Toumi H et al. The relationship between the extensor tendon enthesis and the nail in distal interphalangeal joint disease in psoriatic arthritis—a high-resolution MRI and histological study. Rheumatology (Oxford) 2007;46:253–256.
19. Wittkowski KM, Leonardi C, Gottlieb A et al. Clinical symptoms of skin, nails, and joints manifest independently in patients with concomitant psoriasis and psoriatic arthritis. PLoS One 2011;6:e20279.
20. Martin BA, Chalmers RJ, Telfer NR. How great is the risk of further psoriasis following a single episode of acute guttate psoriasis? Arch Dermatol 1996;132:717–718.
21. Ko HC, Jwa SW, Song M et al. Clinical course of guttate psoriasis: long-term follow-up study. J Dermatol 2010;37:894–899.