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ORIGINAL RESEARCH

A comparative study of childhood psoriasis and atopic dermatitis and greater understanding of the overlapping condition, psoriasis-dermatitis

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ABSTRACT

Background and Objectives: Psoriasis (Pso) in children may be confused clinically with atopic dermatitis (AD) and, indeed, the two conditions may co-exist. The aim of this study was to determine historical and clinical features that are different in paediatric Pso and AD and to describe children who have features of both: psoriasis-dermatitis overlap (PD).

Methods: Children with features of psoriasis or eczema, or both, who were referred to paediatric outpatients and/or private rooms were evaluated. Data were collected from 170 consecutive children aged less than 12 years between July 2011 and November 2011. Participants were classified by described criteria as having Pso ($n = 64$), AD ($n = 62$) or PD ($n = 44$).

Results: Only 9.4% of children with Pso were correctly diagnosed by the referring doctor. Children with Pso relative to AD were more likely to have had a history of scaly scalp and nappy rash in infancy, a family history of psoriasis, current scalp and periauricular rashes, defined, patchy plaque morphology and papulosquamous rashes typical of adult psoriasis on extensor elbows and knees. Children with PD had features of both but presented most often as typical paediatric psoriasis combined with flexural eczema. Children with Pso and PD responded well to specific treatment strategies for psoriasis, including potent topical corticosteroids (TCS), calcipotriol and phototherapy. Both Pso and PD tended to require more potent TCS than AD to achieve disease suppression.

Conclusion: We found that Pso and PD in children both differ clinically from AD and have identified historical and clinical features that characterise childhood Pso.

Key words: atopic dermatitis, childhood, diagnosis, paediatric, psoriasiform dermatitis, psoriasis.

INTRODUCTION

Psoriasis (Pso) is a clinical diagnosis based on history and morphology. Unlike atopic dermatitis (AD), no accepted diagnostic criteria have been established.[1] In the paediatric population, it is the authors' experience that Pso is commonly confused with AD. This led us to identify a need to determine their differentiating features.

We considered this important because of implications for treatment, prognosis and advice to the family. While both AD and Pso are chronic skin diseases and often share a parallel treatment regime in the acute flare stages, maintenance therapy for the two conditions differs, with phototherapy and classical Pso treatment modalities such as calcipotriol and tar-containing preparations being useful in Pso in children.[2] Additionally, the prognosis of AD is good and it is possible to reassure parents that most children, particularly those with mild to moderate disease, will recover spontaneously. However the prognosis for childhood Pso must be more guarded as there are no long-term follow up studies.

Abbreviations:

AD	atopic dermatitis
PD	psoriasis-dermatitis overlap
Pso	psoriasis
TCS	topical corticosteroids

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While differences in adult and childhood Pso are described in the literature, there is little information about how to differentiate childhood Pso from AD in children. Beyond this, it has be estimated that approximately 5% of paediatric patients show an overlap of both eczema and psoriasis[3] and greater understanding of this condition is required.[4]

The aims of this study were to identify the diagnostic features of Pso in childhood that enable the disease to be differentiated from AD, and to investigate the nature of the intermediate or overlap condition, psoriasis-dermatitis (PD).

MATERIALS AND METHODS

A prospective comparative observational study was performed, in which historical and morphological data were collected from 170 consecutive patients aged less than 12 years presenting to a paediatric dermatology clinic in a tertiary referral centre or the private dermatology rooms of one of the authors between July 2011 and November 2011. All patients during this period gave their informed consent. The study was approved by the Human Research Ethics Committee of the Northern Sydney Central Coast Area Health Service.

All patients in the study were referred for the diagnosis and management of acute, chronic or subacute papulosquamous rashes. The presence, or absence, of disease characteristics was noted for each patient. Each patient was classified as Pso ($n = 64$), AD ($n = 62$ or PD ($n =$) as described below. Disease severity was classified using a visual analogue scale.

A literature review was performed using the search engines including Medline, PubMed and Google under search teams, 'childhood psoriasis', 'paediatric psoriasis', 'psoriasis', 'childhood' and 'paediatric'.

The results of this literature review have been tabulated to demonstrate the main features of Pso described in the current literature (Table 1). Based upon this, it is seen that well-demarcated psoriatic plaques, guttate disease, nail pits, acral fingertip eruptions, napkin Pso and pustular Pso were used most commonly when diagnosing Pso in the paediatric population. Although other signs and symptoms were suggested, they did not occur consistently through the current literature and were not thought reliable enough to diagnose patients with Pso. As no definitive criteria exist, the presence of at least one of these features was chosen to classify a patient into the Pso group.

The UK Working Diagnostic Group for the diagnosis of AD was used for the diagnosis of patients in the AD group, whereby patients must have an itchy skin eruption or parental report of scratching or rubbing in a child in conjunction with three of the following: a history of flexural involvement, a personal history of atopy in a child under 10 years of age or in their relative or parent, a history of generalised dry skin in the last year or visual flexural eczema and onset in a child under the age of 2 years (Table 2). Excoriated skin seen on examination was used to confirm parental reports of scratching by the child.

Table 1 Summary of childhood psoriasis literature review

	Well demarcated plaques	Guttate disease	Palmar plantar disease	Nail pits	Napkin psoriasis	Pustular psoriasis	Family history	Acral fingertip eruptions	Psoriatic erythroderma	Koebner phenomenon
Altobelli *et al.* (2007); 1420 patients[5]	X	X	X	X	X	X	X			
Morris *et al.* (2001); 1262 patients[4]	X	X	X	X	X	X	X			
Kumar *et al.* (2004); 419 patients[6]	X	X	X	X		X			X	
Lewkowicz and Gottlieb (2004); Review[2]	X	X		X		X			X	
Rogers (2001); Review[7]	X	X	X	X	X	X	X	X		
Burden (1999); Review[8]	X	X	X		X	X				
Hogan *et al.* (2011); Textbook[9]	X	X		X	X					
De Waard-van der Spek *et al.* (2006); Textbook[10]	X	X		X	X	X			X	
Cohen (2005); Textbook[11]	X	X	X	X	X		X			X
Patel *et al.* (2009); Textbook[5]	X	X		X	X	X		X		
Holm and Helm (2004); Textbook[12]	X	X			X	X		X		X
Patrizi *et al.* (1999); 3 patients[15]	X		X	X						
Dogra and Handa (2004); 1 patient[14]	X			X		X				
Wardrop *et al.* (1998); 1 patient[15]								X		

Table 2 The UK Working Group to establish diagnostic criteria for the diagnosis of AD[16]

Atopic eczema should be diagnosed when a child has an itchy skin condition plus three or more of the following:

1. visible flexural dermatitis involving the skin creases, such as the bends of the elbows or behind the knees (or visible dermatitis on the cheeks and/or extensor areas in children aged 18 months or under)
2. a personal history of flexural dermatitis (or dermatitis on the cheeks and/or extensor areas in children aged 18 months or under)
3. a personal history of dry skin in the last year
4. a personal history of asthma or allergic rhinitis (or history of atopic disease in a first-degree relative of children aged under 4 years of age)
5. onset of signs and symptoms under the age of 2 years (this criterion should not be used in children aged under 4 years)

Patients with features of both groups, classified by displaying features consistent with each group, were considered to be in keeping with PD and thus were removed from Pso and AD groups, respectively. These data were entered into an Excel 2007 database (Microsoft, Redmond, Washington USA).

Statistical methods

Data were analysed using descriptive statistics of the variables studied. Statistical analysis was calculated with SPSS statistical software (ver. 16.0; SPSS 2010 IBM, Armers, NY, USA). Significant differences between the Pso, AD and PD groups were calculated using χ^2 and Fisher's exact test. $P < 0.05$ was considered significant.

RESULTS

Participants were classified by the described criteria as having Pso ($n = 64$), AD ($n = 62$) and PD ($n = 44$). The results are summarised in Table 3.

In the Pso group, there were 23 boys and 41 girls while in the AD group there were 37 boys and 25 girls. This is a significant difference in the proportion of girls with childhood Pso in comparison with AD, which is in keeping with the current literature. The mean age of onset of disease was 2.7 years in the Pso group, 0.6 years for AD and 1.18 years for PD, while the mean age for presentation was 3.6 years in the Pso group, 1.6 years for AD and 2.19 years for PD. There were significantly more severe and more sub-acute AD patients in our cohort compared to severe and sub-acute Pso patients, respectively ($P = 0.03$, $P = 0.01$).

Comparing Pso and AD, there were statistically more patients with a scaly scalp, history of nappy rash, a family history of Pso and the requirement for potent topical corticosteroids (TCS) to achieve objective disease suppression in the Pso group than in the AD group ($P = 0.002$, $P = 0.0001$, $P = 0.0001$, $P = 0.03$). Itch, itch worse at night, a family history of atopy and the requirement of only moderate steroids for response to treatment ($P = 0.003$, $P = 0.0001$, $P = 0.0005$, $P = 0.004$, respectively) was more prevalent in AD than Pso. Steroid classification was based upon guidelines from Therapeutic Guidelines Australia.[17]

When comparing Pso and PD, itch-disturbing sleep, a family history of Pso, a family history of atopy, well-demarcated pink plaques, guttate psoriasis, the presence of genital rash, disease at dorsal hands and ankles, disease periorbitally, perioral and face occurred at significantly different rates between these groups ($P = 0.001$, $P = 0.007$, $P = 0.0001$, $P = 0.007$, $P = 0.001$, $P = 0.01$, $P = 0.003$, $P = 0.01$, respectively). This reflects 10 of 28 clinical end-points for which patients with PD differ from those with Pso.

When comparing AD and PD, scaly scalp, nappy rash, a prior diagnosis of AD, a family history of Pso, a family history of atopy, the presence of disease on dorsal elbows and knees, dorsal hands and ankles, palms and soles, perioral disease and the presence of post-auricular disease occurred at statistically significant different rates between these groups ($P = 0.0.0001$, $P = 0.0001$, $P = 0.05$, $P = 0.05$, $P = 0.04$, $P = 0.007$, $P = 0.03$, $P = 0.0001$, $P = 0.0001$, $P = 0.02$, $P = 0.0001$, $P = 0.02$) This reflects 10 of 16 clinical end-points for which patients with PD differ from AD.

In terms of treatment response we found that 81.3% of Pso, 95.2% of AD and 93.2% of PD had remitted with the initial prescribed treatment at 4–6 weeks follow up. In the Pso and PD groups, this included the use of betamethasone dipropionate 0.05% plus calcipotriol 0.5% (Daivobet, Leo Pharma, Brisbane, Queensland, Australia), topical liquor picis carbonis, in 2% aqueous cream for the face or 4% for the body) and narrow band UVB phototherapy. In the AD group potent TCS were used only for initial management and flares, with moderate to mild TCS used for maintenance with moisturisers and environmental modification.

DISCUSSION

Unlike Pso, diagnostic criteria for AD have been established[16,18] (Table 2) The diagnosis of Pso is clinical and depends on typical morphology and distribution, coupled with family history and supported by a biopsy. The latter is rarely practical in children.

In adults the clinical diagnosis of Pso is usually straightforward; however the morphology of childhood Pso has previously been recorded to differ from adults and may resemble atopic dermatitis or discoid eczema, as plaques in children are thinner, lack white scale and are less well defined.[4] (Fig. 1) In our study Pso was more patchy and well defined than in AD, spared the flexures and genital or nappy area, was more likely to involve the scalp and periauricular skin and less likely to be associated with xerosis and significant itch and it is also less likely to be generalised. (Fig. 2)

It appears from our data that Pso is difficult for non-dermatologists to identify. In our series, only six children with Pso (9.4%) were referred with the correct diagnosis, while 51 (79.9%) of patients with Pso were referred with a diagnosis of AD. The establishment of features that support a diagnosis of childhood Pso may reduce misdiagnosis in the paediatric population and enable clinicians to institute

Table 3 Summary of details

	Psoriasis (Pso) (%)	Atopic dermatitis (AD) (%)	PD (%)	*P* Pso & PD	*P* Pso & PD	*P* AD & PD
General						
Total	64 (37.6)	62 (36.4)	44 (25.9)			
Sex						
Male	23 (35.9)	37 (59.7)	19 (43.2)	0.01	0.55	0.12
Female	41 (64.1)	25 (40.3)	25 (56.8)	0.01	0.55	0.12
Age at onset (average)	2.7 years	0.6 years	1.18 years	0.52	0.004	0.03
Age at diagnosis (average)	3.6 years	1.6 years	2.19 years	0.60	0.02	0.14
Degree						
mild	21 (32.8)	15 (24.2)	8 (18.2)	0.33	0.12	0.49
moderate	18 (28.1)	15 (24.2)	19 (43.2)	0.69	0.14	0.06
severe	2 (3.1)	15 (24.2)	7 (15.9)	0.001	0.03	0.34
Nature						
acute	14 (21.9)	19 (30.6)	10 (22.7)	0.31	0.46	0.39
chronic	22 (34.4)	13 (21.0)	24 (54.5)	0.86	0.03	0.004
sub-acute	6 (9.4)	17 (27.4)	3 (6.8)	0.01	0.74	0.01
History						
Scaly scalp in first year of life	43 (67.2)	24 (38.7)	35 (79.5)	0.002	0.19	0.0001
Nappy rash	40 (62.5)	8 (12.9)	26 (59.1)	0.0001	0.84	0.0001
Itch	47 (73.4)	58 (93.5)	37 (84.1)	0.003	0.24	0.19
Itch-disturbing sleep	29 (45.3)	51 (82.3)	34 (7.3)	0.0001	0.001	0.62
Prior diagnosis of psoriasis	6 (9.4)	5 (8.1)	7 (15.9)	1.00	0.37	0.23
Prior diagnosis of atopic dermatitis	51 (79.7)	54 (87.1)	31 (70.5)	0.34	0.36	0.05
Steroid requirement						
Mild	2 (3.1)	7 (11.3)	3 (6.8)	0.09	0.40	0.52
Moderate	12 (18.8)	27 (43.5)	11 (25.0)	0.004	0.48	0.06
Potent	39 (60.9)	25 (40.3)	27 (61.4)	0.03	1.00	0.05
Family history of psoriasis	42 (65.6)	10 (16.1)	17 (38.6)	0.0001	0.007	0.01
Family history of atopy	29 (45.3)	47 (75.8)	42 (95.5)	0.0005	0.0001	0.007
Personal/family history of						
asthma	18 (28.1)	25 (40.3)	23 (52.3)	0.19	0.02	0.24
eczema	12 (18.8)	23 (37.1)	26 (59.1)	0.03	0.0001	0.03
hay fever	5 (7.8)	9 (14.5)	12 (27.1)	0.27	0.01	0.14
Atopic dermatitis: accepted features						
Generalised dry skin	13 (20.3)	50 (80.6)	41 (93.2)	0.0001	0.0001	0.09
Visible flexural eczema	7 (10.9)	51 (82.3)	37 (84.1)	0.0001	0.0001	1.00
History of flexural eczema	3 (4.7)	41 (66.1)	14 (14.0)	0.0001	0.0002	0.0007
Diffuse non-localised disease	6 (9.4)	34 (54.8)	32 (72.7)	0.0001	0.0001	0.07
Excoriated	1 (1.6)	26 (41.9)	12 (27.3)	0.0001	0.0001	0.15
Psoriasis: accepted features						
Well demarcated plaques	51 (79.7)		41 (93.2)		0.06	
Colour of plaque						
Red	30 (46.9)		13 (29.5)		0.08	
Pink	19 (29.7)		27 (61.4)		0.002	
Skin	1 (1.6)		3 (6.8)		0.30	
Colour of scale						
White	5 (7.8)		4 (9.1)		1.00	
Gray	13 (20.3)		4 (9.1)		0.18	
Nil	2 (3.1)		5 (11.4)		0.12	
Guttate	15 (23.4)		4 (9.1)		0.03	
Acral fingertips	6 (9.4)		9 (20.5)		0.16	
nail pits	17 (26.6)		15 (34.1)		0.52	
Napkin psoriasis	16 (25.0)		11 (25.0)		1.00	
Pustular psoriasis	0 (0.0)		1 (2.3)		0.41	
Genital rash	13 (20.3)	7 (11.3)	1 (2.3)	0.22	0.007	0.14
Degree of scalp scale						
0	36 (56.3)	49 (79.0)	24 (57.1)	0.008	1.00	0.01
1	15 (23.4)	11 (17.7)	13 (29.5)	0.51	0.51	0.17
2	10 (15.6)	2 (3.2)	7 (15.9)	0.03	1.00	0.03
3	2 (3.1)	0 (0.0)	0 (0.0)	0.50	0.51	1.00
Other features identified						
Dorsal elbows/knees rashes	30 (46.9)	9 (14.5)	29 (65.9)	0.0001	0.08	0.0001
Dorsal hands/ankles rashes	10 (15.9)	6 (9.7)	23 (52.3)	0.42	0.0001	0.0001
Umbilicus involved	7 (10.9)	5 (8.1)	8 (18.2)	0.76	0.40	0.14
Palms and soles rash	7 (10.9)	2 (3.2)	8 (18.2)	0.16	0.40	0.02
Eye lid involvement	13 (20.3)	20 (32.3)	20 (45.5)	0.15	0.01	0.22
Lip dryness, fissuring and perleche	13 (20.3)	8 (12.9)	21 (47.7)	0.34	0.003	0.0001
Ear involvement	28 (43.8)	14 (22.6)	20 (45.5)	0.01	1.00	0.02
Face involvement	25 (39.1)	44 (71.0)	29 (65.9)	0.0004	0.01	0.67

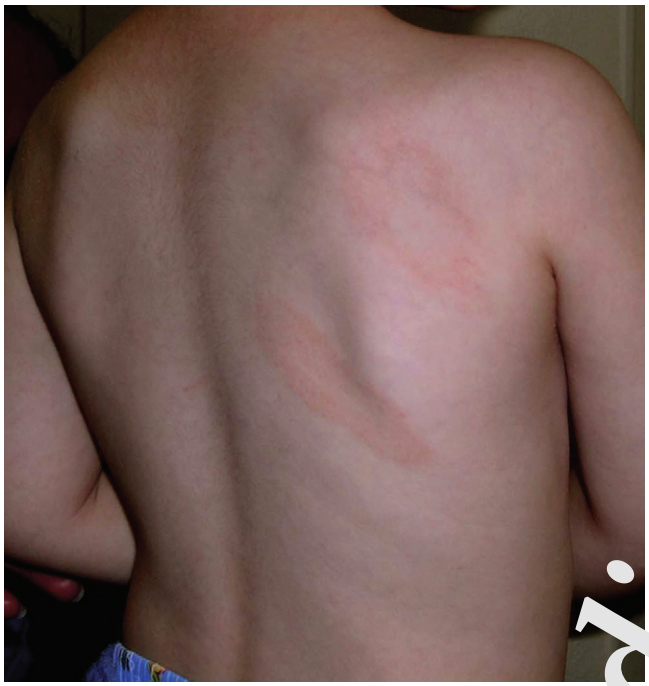

Figure 1 Psoriatic plaque in a child is thinner, paler and less well defined than in an adult and may resemble discoid eczema.

specific treatment. In our cohort, 81.3% of Pso, 95.2% of AD and 93.2% of PD remitted with the initial prescribed treatment at 4–6 weeks follow up. As expected, Pso was the most difficult of the three conditions to manage.

Moreover, we found that many children who were referred with a diagnosis of AD and who had failed to respond to mild or moderate topical corticosteroids, in fact, had Pso or PD and subsequently improved with treatment with potent TCS combined with topical calcipotriol, tars and phototherapy. Our cohort demonstrated that the proportion of patients requiring strong corticosteroid therapy was significantly higher in the Pso group than in the AD group while moderately strong corticosteroids were sufficient in more AD paients than Pso patients.

Treatment resistance may explain the relatively high prevalence of patients with Pso in our cohort, which is well above that expected for the normal population. Pso represented 37.6% of all papulosquamous diseases presenting at our paediatric dermatology referral clinic and practice. Moreover, as can be seen by the proportion of misdiagnoses in the Pso group, patient referrals are typically the clinically challenging patients. We suspect that classic AD responding to treatment initiated in primary care settings is less often referred to a specialist paediatric dermatology centre. This is also evidenced by a significantly higher rate of the clinically challenging severe AD (24.2%) and sub-acute AD (27.4%), when compared to equivalent categories in the Pso group.

It is difficult to obtain an accurate age of disease onset for childhood Pso and AD from parents because the question is

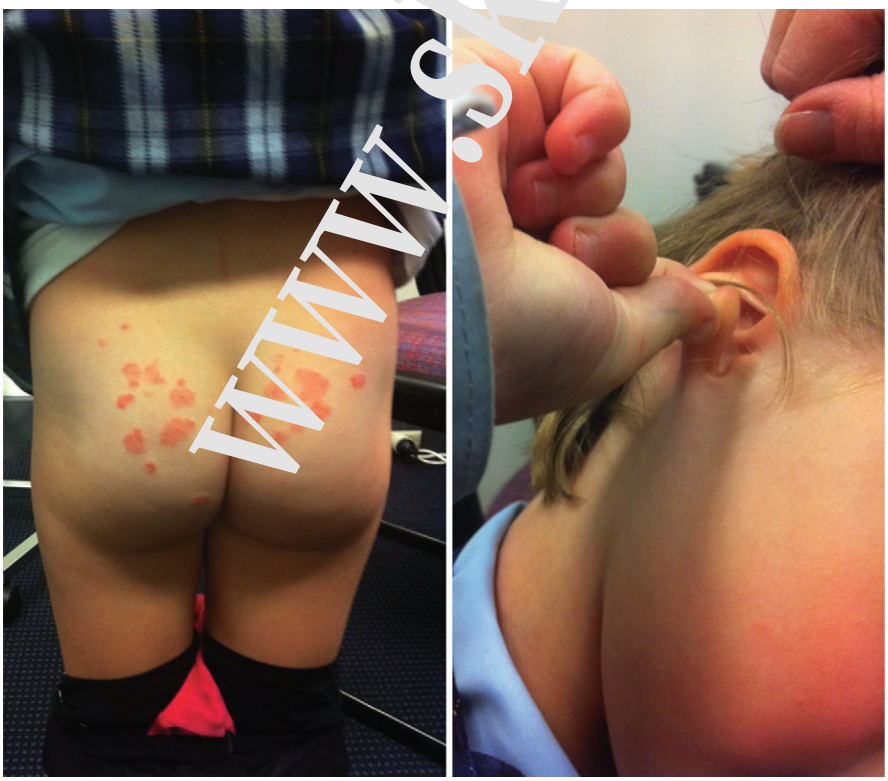

Figure 2 This child with typical guttate psoriasis also demonstrates periauricular rash but does not have xerosis and was only mildly itchy.

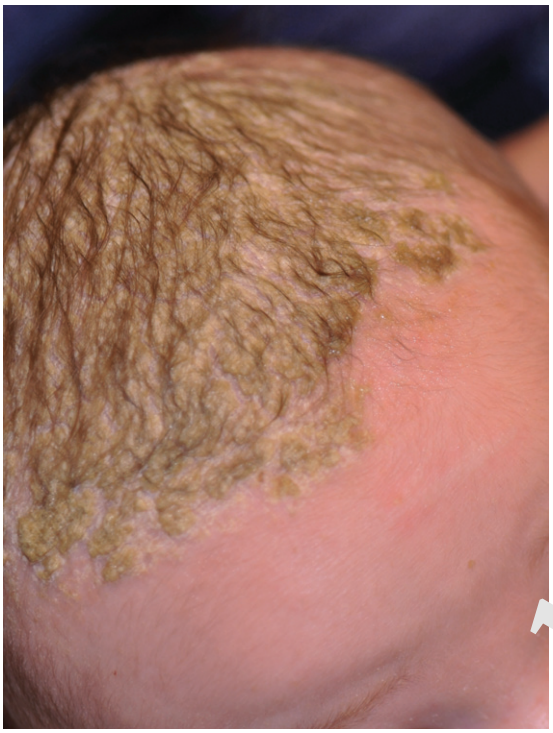

Figure 3 Severe scalp scale in this baby was associated with a family history of psoriasis in the child's mother.

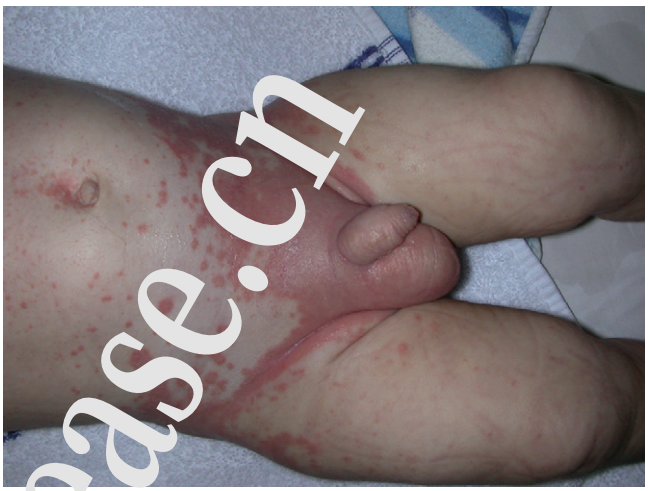

Figure 4 Typical psoriatic nappy rash.

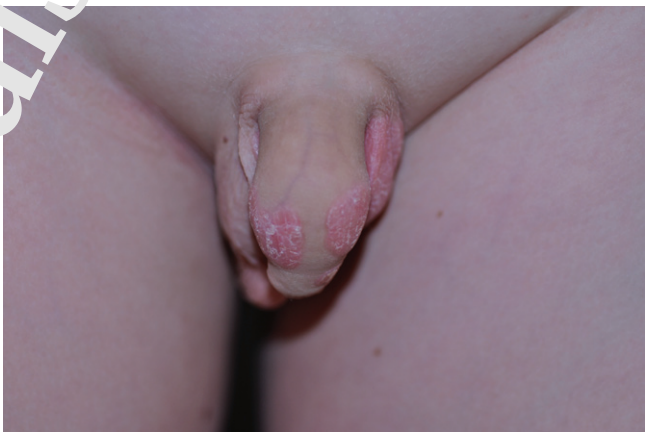

Figure 5 Typical genital psoriasis.

usually asked retrospectively (as was the case in this study) and may be subject to recall bias. The problem is compounded when there is more than one disease process involved, such as for the PD cases that occurred in 6.9% of the preschool-age population. In our study there was no significant difference between the age of onset and the age of diagnosis among the Pso, AD and AD groups and this may be reflected by the relatively large standard deviation around the means (AD 1.03 and 1.75 and Pso 3.15 and 3.44, respectively). The results may suggest that AD begins at a younger age than Pso and presents earlier for medical consultation. It is also possible that AD may occur early and be supplanted by Pso later.

The risk of developing both Pso and AD are increased in first-degree relatives of patients however neither of the conditions has been shown to follow an obvious Mendelian patterns of inheritance.[19] A close genetic link between the conditions is apparent from linkage studies that have identified numerous common susceptibility loci (chromosome 1q21, 3q21, 17q25 and 20p) for AD and Pso.[20] Common genetic factors may be involved in the immunopathophysiology of both conditions, which feature a similar inflammatory cytokine pathway and the predominance of T-cell infiltrates in the dermis.[19]

Historical features demonstrated that scaly scalp (Fig. 3) and nappy rash (Fig. 4) in the first year of life occurred more commonly in the Pso group than the AD group, while itch and itch-disturbing sleep were more common in the AD than Pso group. This could be used to differentiate Pso and AD.

Clinical features diagnostic of AD, including generalised dry skin, visible flexural eczema and history of flexural eczema, were all significantly more prevalent in the AD group than the Pso and PD groups as these end-points were criteria used for defining the AD group. Excoriations were also significantly more frequent in the AD group than in Pso and PD, in keeping with historical itch factors and the diffuse, non-localised disease.

Patients diagnosed with AD who had any of the Pso diagnostic symptoms were reclassified as PD and thus analysis of prevalence of the Pso diagnostic symptoms in the AD group is not possible. There were no cases of Pso with signs of pustular psoriasis however this rare presentation was missed by the small cohort. Genital rash was more common in Pso than PD group (Fig. 5)

Having defined the diagnostic groups, further clinical end-points were examined. It was seen that the presence of a papulosquamous rash (as opposed to typical psoriatic plaques which are uncommon in the paediatric population) over the dorsal knees and elbows, or both (Fig. 6) and

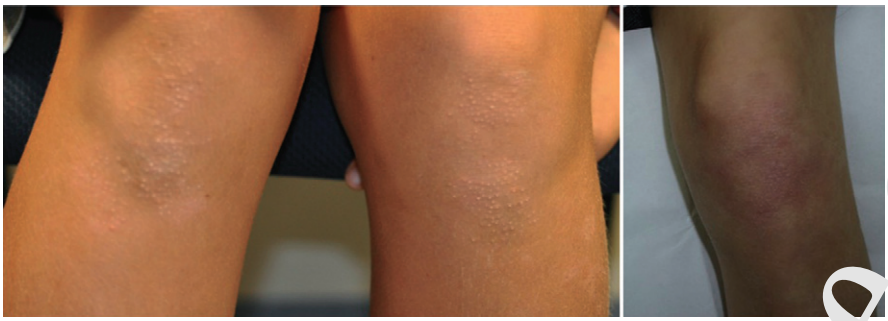

Figure 6 Papular and papulosquamous rashes were commonly found in children with classic signs of childhood psoriasis on other parts of the body.

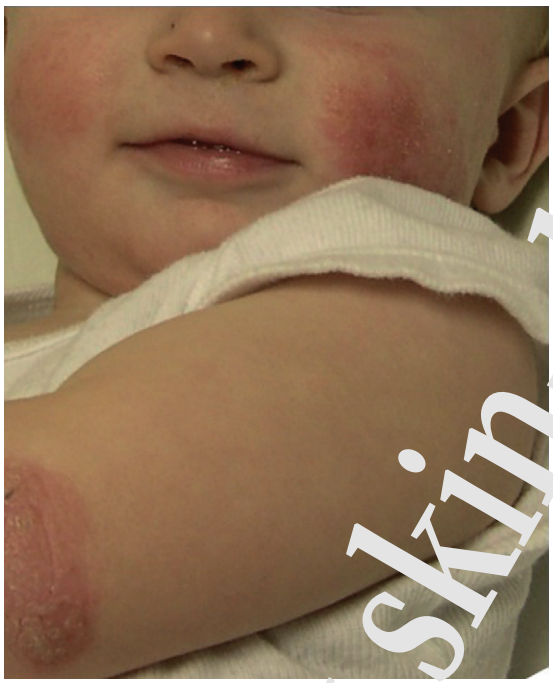

Figure 7 Well-defined facial plaques on this baby with a very well demarcated extensor plaque on the elbow and a family history of psoriasis.

post-auricular and infra-auricular rash and splitting occurred more commonly in the Pso group than in the AD. These could also be used as adjuncts to clinical diagnosis and should be looked for in making a diagnosis of Pso. Moreover, facial involvement was more prevalent in our AD group than the Pso group; however, our results confirm previous reports that facial involvement is relatively common in children with Pso.[4] Further, we noted that the clinical appearance in the Pso group differed from AD in that it presented as defined plaques rather than diffuse facial involvement. (Fig. 7)

With 10 of 28 (35.7%) clinical end-points statistically different from Pso group versus 10 of 16 (62.5%) for AD, PD patients generally appear to have more in common with patients with Pso than those with AD. These patients most often presented as typical childhood Pso with the addition of typical itchy flexural AD and a family history of atopy as well as psoriasis. The most significant of their features was their response to strong corticosteroids, where more PD patients responded to strong treatment than AD patients, suggestive of the treatment requirements of PD in comparison to AD. There is little in the literature on the condition PD and further studies are required.

CONCLUSION

Pso and PD in children both differ clinically and historically from typical adult Pso and from childhood AD and children with the overlap condition PD appear to be closer clinically to patients with Pso in terms of clinical features and treatment requirements. Both Pso and PD respond well to the addition of tar, calcipotriol and phototherapy.

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