

# Diagnostic Dilemmas in Pediatric/Adolescent Dermatology: Scaly Scalp:

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## Introduction:

Scales are laminated and dried masses of keratin and these forms mainly when the rate of formation of epidermal cells is very rapid or normal keratinization is interfered with any pathologic phenomenon, (Odom et al., 2000).

Scalp skin is having several peculiar features. High follicular density of scalp skin is beneficial in providing thermal isolation, Sebum production and desquamated cells provide nutrition to various microorganisms and brushing on the skin of scalp may cause friction injury which can finally leads to the introduction of new microorganisms, (Elweski, 2005).

Scaly scalp is a prevalent disorder in the modern scenario. This condition is a common finding in smaller children less than 10 years old. Scaling of scalp is the important manifestation of various scalp disorders. This is mainly associated with psoriasis, seborrheic dermatitis, dandruff, pityriasis amiantacea, pityriasis rubra pilaris, scaly tinea capitis and few other disorders, (Elweski, 2005). Due to significant overlapping in the clinical manifestations and the pathologic phenomenon, these scalp disorders present diagnostic dilemmas in pediatric and adolescent dermatology. Thus a clear representation and understanding of each disease and its related pathology is very essential to develop an accurate differential diagnosis. Author is presenting a brief overview of each disease related to the scaly conditions of scalp.

In psoriasis condition, lesions are in the form of numerous plaques. Depending upon the severity of the situation these discrete plaques may be pruritic or thickened. Examination with the electron microscope demonstrates irregular corneocytes with clear and dominant outline margins, (Amer et al. 1996). Widening of intercellular spaces along with pathologic lipid

material is also a common finding. Presence of neutrophils and high density desmosomal remnants indicate the occurrence of pathologic interaction, (Ghadially et al., 1996). In this situation parakeratotic corneocytes increase in number while keratohyline granules decrease rapidly.

Seborrheic dermatitis is characterized with the presence of inflammation and pruritis while dandruff creates diffuse, fine, white and greasy scaling of the scalp structure, (Warner et al., 2001). Toxic byproducts and reactive oxygen species produced by *Malassezia furfur* is the main reason of irritation in seborrheic dermatitis, (Nenoff et al., 2001). Electron microscopic examination reveals presence of irregular shaped cells in the stratum corneum layer of epithelium. Trabeculae are also very thin and regularly arranged. Numerous spotty clumps are evident in the stratified layers of stratum corneum; this indicates the presence of yeast, (Pierard-Franchimont et al., 1995). Seborrheic dermatitis usually occurs between first 2 weeks of life. Literature review in this context suggested that it can also occur after 5 months or often recurs after puberty also, but its frequency of occurrence is very little after and during puberty. .

In atopic dermatitis, scaling of scalp is a common finding. It mostly occurs between 0 to 6 months after birth, (Bonifazi E, 1992) and can also occur in children between 0 to 12 years, (Nagaraja et al, 1996). Scabies, langerhans cell histiocytosis and dermatocytosis are other common etiologies of scalp scaling.

In Pityriasis amiantacea, lesions are in the form of asbestos-like appearance. Scales in this disorder are generally overlapped with each other and adherent to the hair and cover them like a sheath (Tracy, 1994).

In pityriasis rubra pilaris, cells are in the numerous forms with fusiform outlines and different depressions and pits on the surface. Trabeculae of cells are mostly regular and numerous parakeratotic cells along with pyknotic nuclei are also evident, (Amer et al., 1996; Kanerva et al. 1983). Epithelial layers exhibit compact and keratin pattern with the presence of lower density filaments.

In *Tenia capitis*, researchers have indicated the presence of perifollicular infiltrate of various cells in the dermal layer. These cells are mainly lymphocytes, histiocytes, plasma cells and

eosinophils. Foreign body giant cell interaction is also present in this situation. This is a common manifestation in children scalp and caused by *Microsporum Audaunii* (Bologna et al., 2003).

A study was conducted on children aged 6 months to 12 years old. Most of children included in this study were black. These children presented with the sign of scaling or other lesions on the scalp, along with these symptoms they were suffering from adenopathy in head and neck region also. Evidences concluded from this study indicated that the presence of both scaling on the scalp and adenopathy is the predictive of tenia capitis in 97% chances and of alopecia in almost 100% cases, (Hubbard TW, 1999).

### **Aims and Objectives:**

Major objective of this study is the determination of approximate prevalence and related different etiological factors of scalp scaling in children. Similar characteristics of various scalp disorders create dilemmas in the final diagnosis thus to establish a definitive diagnosis and to categorize each scalp disorder separately author conducted this study.

Author also concentrated on the findings of lymphadenopathy of head and neck region specifically for the diagnosis of tenia capitis. To establish the association of tenia capitis with the scaling of scalp, this feature is an important finding.

### **Research design and methods:**

Research design for this study was cross sectional. In this study author selected the sample of 300 children. Age group of selected participants ranged from 1 to 10 years. This sample size and study design was approved by Children's Hospital Institutional Review Board. To avoid any legal controversy and to fulfill all prerequisite formalities informed consent was taken from the guardians or parents of participating children. Informed assent was also obtained from the children of appropriate age. Out of 300 children sample, 200 participants were selected from the general pediatric practice at Children's Hospital and Health Center and rest 100 children were enrolled from 2 pediatric dermatology practices. To avoid the chances of any bias a predesigned inclusion and exclusion criteria were used for sample selection. Investigators designed these

criteria very carefully and a team of 2 or 3 investigators evaluated and cross checked it thoroughly. Exclusion criteria included several peculiar and important features. These are as follows:

1. Participants who are suffering from any immunodeficiency disorders and undergoing treatment for the same (or not) are not included in this study.
2. Participants who have been utilized any topical ointment or have taken any medication for the dermatologic disorders are not illegible for this study.
3. Children who have used any medicated shampoo with in the previous 2 weeks are not qualified for this study.
4. Participants who have taken oral antifungal or corticosteroids within the previous months have been excluded from this study.

A team of investigators evaluated each and every participant and received their relevant medical and personal history in detail for the same. Methods of research included following steps:

#### *Collection of data related to the relevant history:*

Questionnaires were distributed to collect information regarding participants' history. Information regarding the demographics of the patients for example their age, gender, ethnicity were gathered from the guardians or parents of the patients. Medical history related to the past or ongoing dermatologic manifestations were also assembled. These disorders were categorized based on their frequency in the general population. Main dermatologic diseases are: (tinea capitis, folliculitis, seborrheic dermatitis, atopic dermatitis, psoriasis, traction alopecia, alopecia areata etc). Other situations were categorized as others, undetermined, or none). Presence of any prior scalp signs or any other symptoms such as scales, pruritis, crusting or papules was also noted for accurate diagnosis. Interpretation of both medical and personal history along with the clinical manifestation was utilized for the final diagnosis of the disorder.

#### *Visual examination:*

Researchers conducted a thorough examination of all participants and examined their scalp. Presence of any current sign or previous scar on the scalp was examined and categorized

accordingly. Adenopathy in the head and neck region was also examined. Presence of any palpable nodes in these regions indicates the presence of particular disorders. Location of adenopathy in anterior, posterior or both areas, consistency and texture of scales obtained from the scalp were beneficial in finalizing the diagnosis. According to the investigators scales which are obtained from the frontal area and of greasy consistency are the characteristic feature of seborrheic dermatitis in infants. These scaling are adherent to the patients' scalp. Other non-adherent and generalized scales were categorized in others column.

#### *Method of diagnosis:*

Mycosel agar was used as a base for the culture of scrapings obtained from the patients' scalp. Several previous investigations have been done in this context and based upon the conclusions of these researches author decided that mycosel agar medium is both sensitive and specific method for the successful diagnosis of dermatophyte infections, (Friedlander SF et al, 1999). In this method a moistened cotton swab was used to collect the scaling from the participants' scalp and then cultured on the pate of mycosel agar. Tap water can be used for moistening the cotton swab. To avoid any discrepancy and bias in the results, all plates were numbered and then incubated at room temperature for approx. 2 weeks. To increase the accuracy of the results 1 blind investigator was appointed to evaluate the plates. This investigator judged the presence of dermatophytes by studying the morphology of different colonies on the mycosel agar plate. In this way, different scaling were obtained and cultured to obtain results.

#### **Statistical analysis:**

Analysis of the questionnaire responses regarding different demographic features was performed by investigators and categorized the participants into clinical groups according to their characteristics. Shapiro – Wilk test was used to check the normality of different variables. Few other tests were used to analyze the differences between clinical groups. Analysis of variance test was used to check the differences between clinic-group means among normally distributed variables and Wilcoxon rank sum test was used to analyze the differences between clinic-group distributions among non- normally distributed variables.

## Results:

Author indicated that there was not any significant difference in demographic features of participants. Age, gender, ethnicity etc were almost similar in the selected participants of different clinical groups. Analysis of these features indicated that half of the selected individuals were less than 2 years old and rest half were ranged from 2-10 years.

New lesions were present in 66 children out of 300. Recent scalp scaling of few months comprised approximately 22% of the entire sample size. Non- significant difference existed in the scaling of scalp between different clinical groups. Neither in the patients less than 2 years old or 2-10 years nor between genders (males and females) was this difference significant. 14% patients' enrolled from the general pediatric practices and 38% enrolled from the pediatric dermatology clinic presented the evidence of current scalp scaling and new lesions of recent origin.

Scalp examination by different investigators concluded the fact that out of 300 participants major etiological factor of scalp scaling in most of the children was the presence of seborrheic dermatitis. Seborrheic dermatitis mainly present in the frontal or vertex region of the scalp and it occurs mainly in the greasy or little bit thicker consistency than the other scrapings from the scalp. It was present in more than half of the participants who categorized under current scaling clinical group and 12% of the overall population. Atopic dermatitis was also evident in the patients who presented with the current scaling. Atopic dermatitis patients comprised approx. 42% of those participants who were enrolled from the pediatric dermatology group and atopic dermatitis or eczema was present in one third of all those patients who presented with current scalp scaling. There was no evidence of presence of any other dermatophyte infection of the scalp. Thorough analysis of all available cases revealed that that most common etiology of scalp scaling in patients less than 2 years old with current scalp scaling is the seborrheic dermatitis and atopic dermatitis or eczema and in the participants aged between 2- 10 years old main etiology was seborrheic dermatitis and atopic dermatitis. A very little proportion of all participants also presented with more than one diagnosis.

Culture of these scarping revealed that total 9 participants showed positive results. These were positive for the dermatophyte infection and their colonies were of black color. 5 participants out of these 9 did not show any clinical symptom and their age ranged from 2 to 10 years. Participants of this group also presented adenopathy features along with the scaling. Rest 4 participants were of less than 2 years old.

Analysis of the patients of the pediatric dermatology group revealed that 21% patients were suffering from atopic dermatitis of recent origin out of these 75% had recent scalp scaling. Further analysis of this group concluded that almost half of the findings were related to the participants aged 1 year and the form of their scaling was thicker greasy type. From the rest half participants 30% had fine scales and scraping of 16% was undetermined.

In the medical history of participants, guardians of children provided the history of eczema in most of the cases. Usage of this broad non specific term for any scalp dermatophyte infection does not provide the accurate information regarding diagnosis. Previous researches indicated that most of the non specific eczema in pediatric patients are atopic dermatitis thus in this study all those patients who presented with the medical history of eczema of previous or recent origin and those patients who gave the history of atopic dermatitis were combined for the ease of further analysis. This discrepancy in the terminology of dermatophyte infections was the common finding in general pediatric clinics but not in the specialist pediatric practices. Health practitioners in these clinics provide further facilities and come up with the accurate diagnosis with its particular terminology.

Analysis of patients for the adenopathy reveals that almost 150 patients out of total 300 participants presented with the adenopathy features in the head and neck regions. There was not any particular distribution of adenopathy in the anterior and posterior region but examination and co-relation of the findings indicated that adenopathy related to the posterior areas of head and neck were related most frequently to the scalp dermatophyte infections and most commonly with the atopic dermatitis or eczema. Cultures were also helpful in diagnosing these infections but they were not significantly associated with adenopathy features. Out of 60 patients with current scalp scraping almost 40 patients presented the adenopathy in both head and neck regions. Seborrheic dermatitis was clearly associated with positive dermatophyte cultures and posterior

head and neck adenopathy. Out of all participants who presented with the symptoms of scalp scaling and adenopathy both only 4 (11%) patients were diagnosed with the tenia capitis.

### **Discussion:**

Analysis of the questionnaire responses of the 300 participants revealed the prevalence and most common etiological factors of scalp dermatophyte infections in children aged from 1 to 10 years.

Thorough data collection and interpretation of findings obtained from 300 participants in this study author concluded that the most frequent etiology in scalp infections in children is the presence of seborrheic dermatitis both in age group less than 2 years and in children aged from 2 to 10 years. Atopic dermatitis or eczema also presented significant association with the scalp scaling but this association was more evident only in the children aged less than 2 years. Thus atopic dermatitis or eczema comprised 22.6 % of overall participants aged less than 2 years when compared to seborrheic dermatitis and this data reached only up to 7% in case of children more than 2 years old in comparison to seborrheic dermatitis.

In this study, author neither manipulated the previous diagnosis of involved participants nor did he attempt to offer a second thought to co – relate the clinical symptoms and history in order to change the diagnosis. He took the diagnosis provided by the treating dermatologist as the final one and categorized the participants according to that only. This may prepare the background of small chances of bias in this study because diagnosis provided by the general physicians use broad term eczema for all scalp dermatophyte infections and this could lead a significant degree of error in categorization of patients. In this study author concentrated mainly upon the thicker and greasy scaling and he did not take other scaling types like non-greasy and fine scaling into account. Thus the chances of presence of any other etiological factors were ruled out completely. Fine and non-greasy scaling is the most common finding in the adult age and this adult type of seborrheic dermatitis is precipitated by the immunologic reaction to the invasive type of lipophilic yeast *Pityrosporum ovale*, (Faergemann J, 2001; Faergemann J, 1997).

This study prepares the background for the further research involving yeast *Pityrosporum ovale* to determine the prevalence and frequency of fine and non greasy scaling in both children and adults. In this study a contradiction with the previous researches is also evident. Prevalence of



culture positivity with the dermatophytes infection is very less when compared to other researches in this context. Literature review of the studies related to the dermatophyte infection of scalps suggests that a small degree of variation in results of each study is acceptable, (Shibaki H, 2003; Sharma, 1998). Growth of colonies on the mycosel agar may also be affected by the geographic variation. Climate change exerts a great effect on the prevalence of dermatophytes. In this study author used the spring season for the growth of the colonies this might be the reason of different result from the previous researches, (Chen BK, 2001).

Another researcher conducted a study to determine the relation between adenopathy and scalp scaling with tinea capitis. He concluded that findings of almost all children proved this relationship true. This fact is proved by the findings of this study also but author did not get sufficient evidence to conclude that this relationship exists only in the case of tinea capitis. Other etiological factors may also show positive culture with the scalp scaling and adenopathy. A successful way of distinguishing between tinea capitis and other etiologies is to check for the size or quality of lymphadenopathy (e.g., large and firm consistency rather than small size and loose texture).

Results of this study clearly indicate that the findings of adenopathy and positive culture are not exclusive for the tinea capitis and to prevent the excessive drug dosage and to prevent the drug resistant in both adults and children a successful diagnosis of etiological agent is very essential.

## **Conclusion:**

Results and evidences summarized from this study concluded that scaling from the scalp of children is a common finding in the modern scenario and the most common etiological factor for this dermatophyte infection is the seborrheic dermatitis. This is the most prevalent cause of scalp infections in children aged from 1 to 10 years old. Apart from the scaling of the scalp adenopathy is also a most consistent finding these days in children. Both anterior and posterior adenopathy in the head and neck region may be related to the dermatophyte infection of wide ranges including atopic dermatitis or eczema.

To increase the reliability of results and for further researches, future studies are recommended in this direction.

# Questionnaire

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1. Write your full name age and gender.
2. Write your address and contact number.
3. Describe in detail your treating dermatologist's name, his location of practice and complete address with contact number.
4. Describe the type of scalp problem you are facing with.
5. What are the most common types of findings you notice in the scalp (Dandruff, scaling, pruritis)?
6. Did you ever feel pustular eruptions on the scalp?
7. Did you ever notice any bleeding points on the scalp?
8. Did you feel unbearable itching on the scalp?
9. Did you ever feel pain related to the lesions or any particular region of the scalp?
10. Did you ever notice any swelling in the head and neck region? If yes then write in detail the location and consistency of the swelling.
11. Did you ever feel pain in the swelling of head and neck region?
12. Did you ever get any treatment for these swellings? If yes then write in detail the diagnosis and treatment u received for the same.
13. Are you suffering from hair loss? If yes then write in detail the duration of this problem.
14. Did you ever scrape any abnormal scaling from the scalp? If yes what was the texture and color of the scarping?
15. Did you ever receive any medication or ointment for your scalp problems? If yes write in detail the name of medications, dosages and the duration of treatment?
16. Did you receive any oral medication or medicated shampoo or any other treatment related to scalp in the previous 3 weeks?
17. Write the past diagnosis related to scalp in detail.
18. Did you notice any improvement in the situation after receiving treatment?
19. Did you continue your treatment as per your doctors' recommendation or you stopped it without any consultation?

20. From how long did you suffer from this scalp problem?
21. Did you develop this problem spontaneously or acquired it as a side effect of some other medication or secondary to any other illness?
22. Are you willing to participate in this research project?
23. Anything else you'd like to share?

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