Original Article

Utility of Quantitative Histopathological Criteria in Differentiating Psoriasis from other Psoriasiform Dermatitis : An Observational Study

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Abstract

Background : Psoriasis and Psoriasiform Dermatitis Closely mimics clinically and histomorphologically with many overlapping features. By differentiating Psoriasis from other Psoriasiform eruptions, one may modify treatment according to the severity of eruptions and the tissues and comorbidities involved. This conundrum might be resolved with the aid of morphometric examination of histological features.

Aims and Objectives : The aim of this study was to analyse and quantify the diagnostic significant parameters using special microscope with inbuilt advanced software for measurement and to evaluate their significance statistically in diagnosis and differentiating Psoriasis from Psoriasiform dermatitis.

Material and Methods : The 70 cases, 33 of Psoriasis and 37 of Psoriasiform Dermatitis were compared by using measurable morphometric parameters with Lawrence and Mayo LM-52-6000 microscope having mosaic V2.1 computational imaging software with professional digital image measurement system. The results were statistically analysed for significance.

Results : Length of rete pegs, length of dermal papillae and the ratio of length/average width of rete pegs showed statistically significant increases in Psoriasis when compared to Psoriasiform dermatitis while suprapapillary thickness and width at 25%/width at 75% in Psoriasis were significantly lower in Psoriasis as compared to Psoriasiform Dermatitis.

Conclusion : All the parameters studied (Length of rete pegs, suprapapillary thickness, length of dermal papillae, the ratio of length/average width of rete pegs and width at 25%/width at 75%) were statistically significant in differentiating and diagnosing Psoriasis when compared to Psoriasiform Dermatitis and can be used to distinguish Psoriasis and Psoriasiform Dermatitis.

Key words : Morphometric Analysis, Psoriasis, Psoriasiform Dermatitis.

Psoriasis is a chronic, relapsing, Papulosquamous Dermatitis that affects >60 million adults and children Worldwide, characterised by silvery scales covering epidermis[1]. Its prevalence rate varies from 0.1 to 0.3% in various parts of World[2,3]. Incidence is twice in males when compared to females and most patients present in their third and fourth decade[4]. They commonly present as chronic dry erythematous, bilaterally symmetrical, well defined scaly papules and plaques. Grattage test and Auzpit's sign can be used along with clinical findings for diagnosis[5]. The presentation of psoriasis may differ clinically depending on the age of lesions and treatment received. The varieties of treatments (conventional and alternative) may make the condition unstable. In these cases, histopathological examination becomes crucial as clinical diagnosis become difficult[6]. Skin biopsy of Psoriasis shows histopathological features of regular epidermal hyperplasia, downward extension of rete ridges, decrease in granular cell layer, suprapapillary thinning, Munro's micro abscess and/or Kogoj's abscess and dilated blood vessels in dermal papillae. These features have been described to be the most constant or characteristic features in standard test books[7-9]. Psoriasis and Psoriasiform Dermatitis must be differentiated histologically as Psoriasiform Dermatitis are a group of disorders

Editor's Comment :

- Future studies should focus on the overlapping cases of psoriasis and psoriasiform dermatitis with specific cases of psoriasiform disorders and diagnostic values to set the proper cutoffs for the morphometric parameters between these groups.

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(Seborrheic Dermatitis, Allergic Dermatitis, Nummular Dermatitis, Prurigo Nodularis, Lichen Simplex Chronicus, Devergie's Disease, Atopic Eczema, Pityriasis Rosea, Inflammatory Linear Verrucous, Epidermal Nevus, Mycosis Fungoides) which simulate Psoriasis clinically and or histologically by findings of elongation of rete ridges with long dermal papillae present alternately and presence of perivascular inflammatory infiltrate[10-12].

Only few studies in the past had used quantitative histopathological methods to differentiate between Psoriasis and Psoriasiform Dermatitis. Morphometric analysis using a special microscope (Lawrence and MayoLM526000) with inbuilt software (Mosaic V2.1 computational imaging software with Professional digital image measurement system) gives a more precise quantitative dimension to histopathology.

The aim of this study was to analyse and quantify the diagnostic significant parameters using special microscope with inbuilt advanced software for measurement and to evaluate their significance statistically in diagnosis and differentiating Psoriasis from Psoriasiform Dermatitis.

The objectives of the study were as follows :

(1) To take micro-metric measures of critical histomorphological parameters in skin biopsies from histopathologically proven Psoriasis cases, as well as similar measurements in other dermatoses that may mimic Psoriasis.

(2) To compare the results statistically in order to determine their diagnostic value in psoriasis differentiation.

(3) To compare and contrast the other major clinical features and histological traits that can be used to narrow down the differential diagnosis.

Material and Methods

Place of Study : Dr DY Patil Medical College Hospital and Research Centre, Dr DY Patil Vidyapeeth (Deemed to be University), Pimpri, Pune.

Type of Study : Descriptive cross sectional study.

Study Design : Comparative study

Period of Study : The time period for study was from September 2022 to May 2024

Study Population : Patients clinically diagnosed and histopathologically confirmed as Psoriasis and Psoriasiform Dermatitis in the Department of Dermatology and Pathology.

Inclusion Criteria :

Clinically and histopathologically diagnosed patients of Psoriasis and Psoriasiform dermatitis who had given informed consent to undergo required investigation in the study.

Exclusion Criteria :

(1) Non-consenting patients

(2) Autolysed skin biopsies

(3) Biopsies, which have less than five well defined rete pegs.

Sample size : The sample size was calculated using software WinPepi v11.38. Minimum sample size calculated is 26 biopsies with 13 biopsies in each group. However, all the samples related to our study during the time duration of our study were taken. The study group comprised of skin biopsies of 70 patients clinically diagnosed and confirmed histologically as Psoriasis and Psoriasiform dermatitis were included. Total of 33 constitutes Psoriasis (Class A) and remaining 37 were of Psoriasiform Dermatitis (Class B).

Sampling Method : Consecutive sampling

Ethical clearance : The study was evaluated and approved by the Institute Ethical Committee with research protocol number IESC/PGS/2022/196

Consent : Prior written and informed consent was obtained from all the patients participating in the study. Data was collected and analysed after ensuring the confidentiality of their information.

Method of data collection : Biopsies of patients clinically suspected as Psoriasis and other dermatitis that Mimics Psoriasis were taken by the Dermatologist after prior written and informed consent. The biopsies were sent to Department of Pathology in 10% formalin along with the test requisition form with detailed local examination including the presenting morphological features of the lesion. These presenting morphological features of the lesion were recorded and received biopsies were allowed to fix in 10% formalin for 17 hours before processing and embedding with paraffin wax. The hematoxylin and eosin stained 3-to-4-micron thick section slides were prepared from paraffin blocks and clinical diagnosis of Psoriasis or other Psoriasiform Dermatitis was confirmed histopathologically. The features of

histopathological importance like Hyperkeratosis, Parakeratosis, Munro's Micro Abscess, Acanthosis, Kogoj's Microabscess, Orthokeratosis, Dilated and Tortous Blood Vessels, Inflammatory Cells in the dermis were noted before the slides were examined for the morphometric measurements. The multiple measurements were made in 10 X and 40 X fields in different areas for all the parameters by two different Pathologists separately and the average was calculated. The measurements were made in micrometres (μm) with an inbuilt scale which adjusted automatically with different magnification. The parameters were measured as follows (Fig 1).

(a) The length of rete pegs – the distance from the upper part of the granular layer to the bottom of the dermis.

(b) The length of dermal papillae – the length of dermal papillae was measured from the tip of the dermal papillae to the base at the level of tip of rete pegs.

(c) Suprapapillary thickness – suprapapillary thickness was measured from the tip of dermal papilla to the top of the granular layer.

(d) Width at 25% / width at 75% – the ratio of measurement at upper narrowest and lower widest part of the rete pegs.

(e) Length over average width of rete pegs-The ratio of length to average width of rete pegs were calculated by dividing the length of papillae by average width.

The granular layer thickness was assessed by counting the number of granular cells vertically in the suprapapillary area and at the base of the rete pegs.

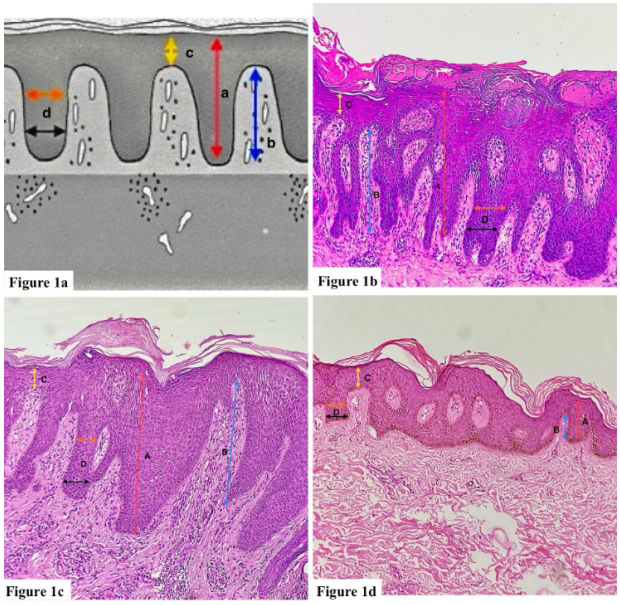

Fig 1 — Schematic diagram showing the measured parameters

Instrument used : Lawrence and Mayo LM52-6000 microscope, having Mosiac V2.1 computational imaging software with professional digital image measurement system.

Statistic analysis : Data collected was subjected for appropriate statistical analysis to perceive valid conclusions. The normality was assisted by using Shapiro-wilk test. The statistical analysis was assessed by using Chi-square Test, Mann-whitney U and P value were calculated.

Results

Examination of the histopathological slides was done by 2 Pathologists independently, and high concordance rate was noted between them. Out of 70 biopsies studied 33(47.14%) were of Psoriasis and 37(52.86%) were of Psoriasiform Dermatitis. The mean age was found to be 36.63 years for Psoriasis and 44.24 years for Psoriasiform dermatitis.

The majority of the patients of Psoriasis were between 30-50 years and that of Psoriasiform dermatitis between 40-50 years. The male preponderance was noted in both classes with male:female ratio of 1.75:1 in Psoriasis and 1.64:1 in Psoriasiform dermatitis. According to the clinical data recorded and provided by the Dermatologist Erythema, Papules, Plaques and Micaceous Scales were Predominant Morphological pattern of presentation in Psoriasis while majority of Psoriasiform dermatitis presented with Papule, Plaque and Erythema. Only the cases of Psoriasis showed the Micaceous scales and positive Auspit'z sign. The histopathological features were recorded in both classes of which Munro's micro abscess and Sponjioform pustules of Kogoj, hypogranulosis, tortous blood vessels were more frequently present in cases of Psoriasis. Tables 1 & 2 shows frequency of important clinical and histopathological features in both classes respectively. The morphometric analysis done revealed that all studied parameters ie, Length of rete pegs ($U=184$, $p \leq 0.001$), Suprapapillary thickness ($U=412$, $p=0.02$), Length of dermal papillae ($U=271$, $p \leq 0.001$), Length of rete pegs/average width ($U=283$, $p \leq 0.001$), width at 25%/width at 75% ($U=157$, $p \leq 0.001$) shows significant difference between both the classes. Tables 4 & 5 shows Morphmetric analysis of important histological features between Class A and Class B with their median and statistical significance.

Table 1 — *Histological findings in Psoriasis and Psoriasiform dermatitis*

Histopathological Features	Psoriasis N=33(100%)	Psoriasiform Dermatitis N=37(100%)
Acanthosis	31(93.93%)	25(67.56%)
Hyperkeratosis	21(63.6%)	19(51.35%)
Parakeratosis	32(96.9%)	29(78.37%)
Orthokeratosis	29(87.8%)	04(10.81%)
Munro's Micro abscess	18(54.5%)	0
Sponjioform pustule of kogoj	10(30.3%)	0
Dillated and tortous blood vessels	33(100%)	33(89.18%)
Inflammatory infiltrate in dermis	33(100%)	33(89.18%)

Table 2 — *Clinical findings in Psoriasis and Psoriasiform dermatitis*

Clinical features	Psoriasis N = 33(100%)	Psoriasiform Dermatitis N = 37 (100%)
Macule	5(15.15%)	6(16.21%)
Patch	1(3.03%)	4(10.81%)
Papule	25(75.7%)	24(64.86%)
Plaque	33(100%)	21(56.75%)
Erythematous	30(90.90%)	21(56.75%)
Skin coloured	2(6.06%)	9(24.32%)
Violaceous	Nil	Nil
Hyper pigmented	22(66.66%)	18(48.64%)
Micaceous scale	33(100%)	4(10.81%)
Koebnerisation	6(18.18%)	3(8.10%)
Auspitz' sign	26(78.78%)	2 (5.40%)

Discussion

Psoriasiform Dermatitis is a group of disorders which clinico-histologically resemble Psoriasis either in beginning/course of progression or in the resolution[6].

Table 4 — *Independent Samples T-Test for significance*

Parameters	Test of significance	Statistics (U value)	P value	Signi-ficance
Length of rete pegs	Mann-Whitney U	184	<0.001	+
Supra papillary thickness	Mann-Whitney U	412	0.02	+
Length of dermal papillae	Mann-Whitney U	271	<0.001	+
Length of rete pegs/ average width	Mann-Whitney U	283	<0.001	+
Width at 25%/ width at 75%	Mann-Whitney U	157	<0.001	+

Note. $H_{a\ \mu Psoriasiform\ Dermatitis} \neq \mu_{\ Psoriasis}$

Hence, it is necessary to differentiate Psoriasis from Psoriasiform Dermatitis histopathologically. Morphometric histopathological image analysis has gained immense interest in recent years with digitisation and development of artificial intelligence. In cases where histopathology could not clinch a diagnosis then morphometric analysis along with clinico-histopathological concordance can be considered. In the present study morphometric analysis of major histological features of 70 skin biopsies were studied of which 33 were of Psoriasis is and 37 were of Psoriasiform Dermatitis.

In our study we found that Psoriasis was more common in third decade, followed by fourth decade, and Psoriasiform Dermatitis in 4th decade. Bedi T R also found that Psoriasis was more common in the 3rd to 4th decade[13].

Table 3 — *Morphometric analysis in Psoriasis and Psoriasiform Dermatitis with Mean, Median, SD, IQR, Minimum & Maximum values obtained along with Test for Normality*

Variable/Category	Frequency	Mean in µm	SD	Median in µm	IQR	95% CI Mean	Min in µm	Max in µm	Normality
Length of rete pegs :									
Psoriasiform Dermatitis	37	229.18	99.76	232.13	173.5-268.37	195.92-262.44	62.75	582.07	Rejected
Psoriasis	33	412.95	142.3	425.3	314.99-488.81	362.5-463.41	129.21	638.85	Accepted
Total	70	315.82	152.05	274.35	202.86-429.67	279.56-352.07	62.75	638.85	Rejected
Supra papillary thickness :									
Psoriasiform Dermatitis	37	72.88	24.04	69.62	52.46-89.34	64.87-80.9	37.38	129.65	Rejected
Psoriasis	33	50.52	18.91	46.8	38.83-56.16	43.81-57.22	29.79	107.54	Rejected
Total	70	62.34	24.37	55.17	42.77-79.87	56.53-68.15	29.79	129.65	Rejected
Length of dermal papillae :									
Psoriasiform Dermatitis	37	166.61	75.6	156.94	116.55-188.99	141.4-191.81	35.12	449.1	Rejected
Psoriasis	33	251.22	106.25	225.98	182.98-327.84	213.55-288.9	33.75	457.58	Accepted
Total	70	206.5	100.14	184.26	146.37-260.71	182.62-230.37	33.75	457.58	Rejected
Length of rete pegs / average width :									
Psoriasiform Dermatitis	37	3.58	1.52	3.56	2.53-4.68	3.08 - 4.09	1.22	8.1	Accepted
Psoriasis	33	5.43	2.1	5.14	3.9-6.63	4.69-6.18	2.1	10.8	Accepted
Total	70	4.46	2.03	4.05	2.94-5.49	3.97-4.94	1.22	10.8	Rejected
Width at 25% / width at 75% :									
Psoriasiform Dermatitis	37	1.32	0.36	1.3	1.09-1.6	1.2-1.44	0.44	1.97	Accepted
Psoriasis	33	0.87	0.22	0.82	0.71-0.95	0.79-0.95	0.51	1.45	Rejected
Total	70	1.11	0.37	1.02	0.82-1.4	1.02-1.2	0.44	1.97	Rejected

In our study male as to female ratio of 1.75:1 and 1.64:1 was noted in Psoriasis and Psoriasiform Dermatitis respectively, indicating males were affected more than female in both the classes. Similar observations were made by Icen, *et al* and Chandanwale, *et al*[14,15].

In Psoriasis patients of our study, according to the clinical data provided it was observed that in patients with Psoriasis Plaque (77.14%), Erythematous (58.82%), Micaceous scale (89.19%) and Auspitz sign (92.86%) were significantly higher than patient with Psoriasiform Dermatitis ($p<0.05$) which is in concordance with Veena AB, *et al* and Meier Seth study[6,16].

Among the studied histological features both Psoriasis and Psoriasiform Dermatitis showed Acanthosis, Hyperkeratosis, Parakeratosis, Orthokeratosis along with inflammatory infiltrate in the dermis. Presence of Orthokeratosis ($P\leq0.001$), Munro's Micro abscess ($P<0.001$), spongioform Pustule of kogoj ($P<0.001$) dilated and tortous blood vessels ($P<0.001$) were significant in psoriasis when compared with Psoriasiform Dermatitis. With the loss of granular layer in Psoriasis, Parakeratosis become confluent and there is migration of the neutrophils into parakeratotic scale through epidermis resulting in intracorneal collections called as Munrosp microabscess. Such accumulation in stratum spongiosum are called spongioform pustule of kogoj. The histopathological findings are in close agreement with Venne AB, *et al,* Chandanwale, *et al*, Lal, *et al*, Gordon and Johnson, Mehta, *et al* and Narayankar, *et al*[6,15,17-20].

When morphometric parameters were studied for statistical significance (as data is skewed nonparametric test ie, Mann whitney 'U' test was used) and following results were obtained. Length of rete pegs ($U=184$, $P\leq0.001$), Suprapapillary thickness ($U=412$, $P=0.02$), Length of dermal papillae ($U=271$, $P\leq0.001$), Length of rete pegs/average width ($U= 283$, $P\leq0.001$), width at 25%/ width at 75% ($U=157$, $P\leq0.001$) were found to be statistically significant.

The median length of rete pegs in cases of Psoriasis was 425.3µm and IQR of 314.99 - 488.81µm and in cases of Psoriasiform Dermatitis median calculated was 232.13µm with IQR of 173.5-268.37µm. The median rete pegs length in Psoriasis is 1.83 times greater than in Psoriasiform Dermatitis. The difference in rete pegs length in our study was significant with $U=184$, $P\leq0.001$. Chandanwale, *et al* found that rete pegs length in Psoriasis was 1.74 times greater than Psoriasiform Dermatitis ($t=4.036$ and $P=0.0001$)[15].

The median suprapapillary thickness of epidermis overlying the dermal papilla in cases of Psoriasis was 46.8µm with IQR of 38.83-56.16um while in psoriasiform dermatitis it was 69.62um with IQR 52.46-89.34µm. The difference in them was statistically significant with $U=412$, $P=0.02$. Chandanwale, *et al* also did similar study however it was not statistically significant ($t=1.543$, $P=0129$)[15]. Ghasemi, *et al* did similar study for suprapapillary thickness in cases of Psoriasis and Chronic Dermatitis, they also found that difference between them was statistically significant[21].

The median length of dermal papillae in cases of Psoriasis was 225.98um with IQR 182.98- 327.84µm while in cases of Psoriasiform Dermatitis it was 156.94µm with IQR 116.55-188.99µm. The psoriatic dermal papillae were 1.43 times longer than Psoriasiform Dermatitis. The difference in length of dermal papillae was significant with $U=271$, $P\leq0.001$. Chandanwale, *et al* also found significant difference in length of dermal papillae with dermal papillae of psoriasis being 1.89 times that of Psoriasiform Dermatitis[15].

Shape of rete pegs were demonstrated by the ratio of average length to width of rete pegs. The greater the ratio narrower are the rete pegs. Median ratio with IQR was calculated. In Psoriasis it was 5.14 with IQR 3.9-6.63 µm and in Psoriasiform Dermatitis it was 3.56 with IQR 2.53-4.68 µm. The difference in this ratio between two classes was statistically significant witjh $U=157$, $P\leq0.001$. The higher ratio in psoriatic biopsies favour the histopathological finding of long slender rete pegs in them. Similar findings were observed by Chandanwale, *et al* and Ghasemi, *et al*[15,21].

In Psoriasis club shaped rete pegs are seen. In an attempt to determine the clubbing ratio of width of rete pegs at 25% of length to that at 75% length was calculated. The lower the ratio the more the clubbing of the rete pegs. In cases of Psoriasis the median ratio of 0.82 was obtained with IQR 0.71-0.95 µm and in Psoriasiform Dermatitis ratio of 1.3 with IQR 1.09-1.6 µm was seen. The difference in this ratio was statistically significant with $U=157$, $P\leq0.001$. Chandanwale, *et al* also observed lower ratio in cases of Psoriasis than Psoriasiform Dermatitis however it not statistically significant ($t=0.002$ and $P=0.983$)[15]. Probable reason being that in our study more advance software with precision was used.

9 cases (27%) of Psoriasis showed absence of granular cell layer while remaning 24(73%) cases showed <3 granular cell layer, all cases of Psoriasiform Dermatitis showed ≥3 cell layer. Ghasemi, *et al* made an attempt in calculating the thickness of granular cell layer in Psoriasis and chronic dermatitis[21]. They found that the granular layer in Psoriasis is significantly thinner. Many other studies reported the similar findings[15,18,19].

Limitations

The major limitation of our study is that we examine biopsies that were clinically diagnosed and histologically confirmed as Psoriasis and Psoriasiform Dermatitis, while histopathology is a vital rule and is utmost needed in modern cases. Do we have to start with typical cases considering our study is nearly starting point? Further future research should certainly focus on borderline cases.

Conclusion

Psoriasiform Dermatitis is the major differential diagnosis, clinically and histopathological of Psoriasis. Some histopathological features ie, regular Epidermal Hyperplasia, Munro's Micro Abscess, Spongiform Pustule of Kogoj, Suprapapillary Thinning, Decreased Granular Cell Layer Favours Diagnosis of Psoriasis. However Severity, Disease Duration, Excoriation Related Changes, Site of Biopsy may affect majority of these parameters. Hence, the diagnostic accuracy can be increased by using the quantitative parameters (Length of Rete Pegs, Length of Dermal Papillae, Suprapapillary Thickness, Length over Average width of the Rete Pegs, Ratio of width at 25% Length Over 75% Length of Rete Pegs). More studies with advance measurement system are needed to confirm and substantiate these findings.

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