A Cross-Sectional Study of Clinico-etiological Profile and Associated Comorbidities in Indian Patients of Pigmented Purpuric Dermatoses

Gunjan Gupta, Sabha Mushtaq¹, Devraj Dogra¹, Ghanshyam Dev², Rahul Sudan³, Naina Dogra¹

Abstract

Background: Pigmented purpuric dermatoses (PPDs) are a group of chronic benign vascular disorders with varied clinical presentation. The etiopathogenesis of the condition largely remains unknown with a paucity of clinico-epidemiological and/or clinico-etiological studies. Objective: To study the clinico-epidemiological pattern, etiological factors and associations of PPD and correlate them with its severity in a set of Indian patients. Materials and Methods: In a cross-sectional study, all clinically diagnosed and histopathologically confirmed cases of PPD attending the outpatient department of dermatology from November 2015 to October 2016 were included in the study. Patients were evaluated based on a detailed history of the illness, comorbid conditions, drug usage, general physical, systemic, and cutaneous examinations, severity of disease (mild, moderate, or severe), laboratory parameters, and Doppler ultrasonography of the lower extremities. Results: There were a total of 60 patients with a female-to-male ratio of 1.14:1. The mean age of patients was 47 ± 12.10 (range: 15–70) years. Majority (70%) of the patients were housewives, bankers, and businessmen. The possible etiological and/or aggravating factors included prolonged standing (28.3%), drug intake (13.3%), alcohol ingestion (10%), strenuous exercise (5%), and varicose vein (3.3%). Schamberg’s disease (90%) was the most common type observed. The most common systemic comorbidity identified was hypertension (58.3%) followed by diabetes mellitus (31.6%) and dyslipidemia (28.3%). A positive correlation was found between severity of the disease and presence of comorbidities (Mantel–Haenszel method, P < 0.0001). Conclusion: PPD was found to be associated with a variety of disorders and comorbidities. The number of the comorbidities increased with increasing severity of the disease. Besides exposing the patient to various risk factors, this may contribute to the vessel wall damage seen in the condition. All patients with PPD should, therefore, undergo an initial screen for these comorbidities.

KEY WORDS: Clinicoetiology, comorbidities, epidemiology, pigmented purpuric dermatosis

Introduction

Pigmented purpuric dermatoses (PPDs) are a group of chronic benign vascular dermatoses characterized by capillaritis with extravasation of erythrocytes and hemosiderin-laden macrophages into the skin. It manifests clinically as petechiae or ecchymosis, papules or plaques of red, purple, yellow, or brown color which results from the deposition of hemosiderin within the dermis. The most common sites of affliction are the lower extremities, but lesions can also develop within the dermis. The most common sites of affliction are the lower extremities, but lesions can also develop within the dermis. The most common systemic comorbidity identified was hypertension (58.3%) followed by diabetes mellitus (31.6%) and dyslipidemia (28.3%). A positive correlation was found between severity of the disease and presence of comorbidities (Mantel–Haenszel method, P < 0.0001).

Conclusion: PPD was found to be associated with a variety of disorders and comorbidities. The number of the comorbidities increased with increasing severity of the disease. Besides exposing the patient to various risk factors, this may contribute to the vessel wall damage seen in the condition. All patients with PPD should, therefore, undergo an initial screen for these comorbidities.
PPD has been classified into five main clinical types: Schamberg’s disease (progressive PPD), Majocchi’s disease (purpura annularis telangiectodes), pigmented purpura annularis of Gougerot and Blum, eczematid-like purpura of Doucas and Kapetanakis, and lichen aureus. Other rare variants of PPD include itching purpura, unilateral linear capillaritis, quadratic, transitory, and granulomatous pigmented purpura. However, some authors consider itching purpura and eczematid-like purpura of Doucas and Kapetanakis as a single entity. The wide variety of PPD subtypes differ morphologically but share several common histopathologic features with only minor differences in some of the subtypes. However, this usually does not affect the prognosis or management.

Although the disease is asymptomatic and majority of the patients seek consultation for cosmetic concern, lately several systemic diseases have been reported to be associated with the disease. There is a paucity of data on the clinical characteristics and pattern of PPD. To the best of our literature search, most of the studies published on the topic are record based and retrospective. There has been only one prospective study on PPD from India.

The present study was, therefore, undertaken to find the possible etiological/aggravating factors and associations with other comorbid conditions and correlate with respect to severity of PPD.

Materials and Methods

This was a cross-sectional study carried out in the postgraduate department of dermatology, venereology, and leprology over a period of 1 year, from November 2015 to October 2016, after obtaining approval from the institutional ethics committee.

All clinically diagnosed and histopathologically confirmed cases of PPD were included in the study. Patients with palpable purpura, stasis dermatitis due to venous HTN or purpura due to other causes such as scurvy, Henoch–Schonlein purpura, and thrombocytopenia were excluded from the study. The sample size was calculated based on the reported prevalence of comorbidities in PPD patients of 70.8%. Using 95% confidence interval and relative precision of 14%, the required sample size was estimated to be 55 using the formula \( n = \left( z \right)^2 p \left( 1-p \right) / d^2 \) where \( n \) is the sample size, \( z \) is the statistic corresponding to level of confidence, \( p \) is expected prevalence, and \( d \) is the precision.

A detailed history regarding age, sex, occupation, duration, site of onset and progression of the disease, associated symptoms, history of local application, drug and alcohol intake, type of clothing, and focal sites of infection was recorded. The history of hematological disorder, diabetes, HTN, hepatitis, hyperlipidemia, thyroid dysfunction, rheumatoid arthritis, and family occurrence in the family was also recorded.

Thorough general, systemic, and cutaneous examinations were carried out in good daylight. The site, distribution, and type of skin lesions and their color and morphology were recorded along with examination of mucosae, nails, hair, and scalp for the presence of any other diseases. The disease severity was graded based on the extent of involvement into (i) mild if only ankle and feet or <1% body surface area (BSA) up to ankle was involved, (ii) moderate if ankle and feet extending up to lower one-third of the leg or ≥1% BSA confined up to lower one-third of the leg was involved, and (iii) severe if ankle and feet extending beyond lower one-third of the leg and/or distant site was involved irrespective of the BSA.

Skin biopsy was done in all cases to confirm the diagnosis. Laboratory investigations included complete blood count, bleeding and clotting time, erythrocyte sedimentation rate and C-reactive protein, liver and renal function tests, fasting blood sugar, viral markers, rheumatoid factor, thyroid, and lipid profile. Doppler ultrasonography of lower limb veins was done in all the patients to rule out any venous insufficiency.

Categorical variables were presented as frequency and percentage and quantitative variables as mean with standard deviation (SD). Relative risks were calculated using Mantel–Haenszel method employing Epi Info™ 6.0 (CDC, Atlanta, GA, USA). \( P < 0.05 \) was considered statistically significant.

Results

Background characteristics

There were a total of 60 patients of which 32 (53.3%) were female and 28 (46.7%) were male. The mean age of the patients was 47.37 ± 12.10 years, ranging from 15 to 70 years. The most common affected age group was 40–50 years with 26 (43.3%) patients followed by 51–60 years with 12 (20%) patients. Housewives comprised 27 (45%) cases followed by businessmen 8 (13.3%), bankers 7 (11.7%), teachers 7 (11.7%), students 4 (6.7%), policemen 4 (6.7%), and others 3 (5%). The clinicodemographic profile of study population is given in Table 1.

Disease characteristics

Mean duration of the disease was 14.85 ± 17.99 (median: 7) months. Schamberg’s disease in 54 (90%) patients was the most common clinical type seen, followed by itching purpura in 4 (6.7%), Majocchi’s disease in 1 (1.7%), and
lichen aureus in 1 (1.7%) patient [Figure 1]. None of the patient presented with pigmented purpuric lichenoid dermatoses of Gougerot and Blum. Lower extremity was the predominant site of involvement with concomitant involvement of the feet, ankles, and legs in 25 (41.7%) cases followed by ankles and legs in 15 (25%), ankles only in 6 (10%), legs in 5 (8.3%), feet and ankles in 5 (8.3%), and feet alone in 3 (5%) cases. Only 1 (1.6%) patient had lesion present on site other than legs [Table 2].

**Table 1: Clinicodemographic characteristics of the study population (n=60)**

| Variable                        | Frequency (%) |
|---------------------------------|---------------|
| Age group (years)               |               |
| 11-20                           | 3 (5.0)       |
| 21-30                           | 1 (1.7)       |
| 31-40                           | 10 (16.7)     |
| 41-50                           | 26 (43.3)     |
| 51-60                           | 12 (20.0)     |
| 61-70                           | 8 (13.3)      |
| Occupation                      |               |
| Housewife                       | 27 (45)       |
| Business                        | 8 (13.3)      |
| Banker                          | 7 (11.7)      |
| Student                         | 4 (6.7)       |
| Farmer                          | 2 (3.3)       |
| Teacher                         | 7 (11.6)      |
| Tailor                          | 1 (1.7)       |
| Policeman                       | 4 (6.7)       |
| Duration of disease (years)     |               |
| <1                              | 31 (51.7)     |
| 1-2                             | 21 (35)       |
| 3-4                             | 3 (5)         |
| >4                              | 5 (8.3)       |
| Aggravating factor              |               |
| Strenuous exercise              | 3 (5.0)       |
| Varicose veins                   | 2 (3.3)       |
| History of drug intake          | 8 (13.3)      |
| History of prolong standing     | 17 (28.3)     |
| Alcohol ingestion               | 6 (10.0)      |
| Unknown                         | 24 (40.0)     |
| Morphology of lesion            |               |
| Purpura                         | 3 (5.0)       |
| Macule                          | 3 (5.0)       |
| Plaque                          | 5 (8.3)       |
| Macule and purpura              | 20 (33.3)     |
| Macule and plaque               | 10 (16.7)     |
| Purpura and plaque              | 9 (15.0)      |
| Macule, plaque, and purpura     | 10 (16.7)     |
| Color of the lesion             |               |
| Red                             | 9 (15.0)      |
| Orange                          | 3 (5.0)       |
| Brown                           | 23 (38.3)     |
| Reddish brown                   | 25 (41.7)     |

Based on the extent of involvement, the disease was found to be severe in 26 (43.3%), moderate in 20 (33.3%), and mild in 14 (23.3%) patients. While the disease was asymptomatic in most (90%), only six patients (10%) with itchy purpura complained of pruritus. The most common morphology of skin lesions was a combination of macules and purpura (33.3%), while the most common color of the lesions was reddish brown (41.7%) [Table 1]. Histopathology in majority of the cases revealed superficial perivascular lymphocytic infiltration with scattered red blood cell extravasation and mild degree of hemosiderin deposition [Figure 2].

**Etiologic/aggravating factors, laboratory parameters, and comorbidities**

The etiological factors observed were prolonged standing in 17 (28.3%), alcohol intake in 6 (10%), strenuous exercise in 3 (5%), and varicose vein in 2 (3.3%) cases [Table 1]. Eight patients were using drugs for diseases other than PPD. These included amlodipine, losartan, and statins. In 24 (40%) patients, no etiological or aggravating factor could be traced. None of the patients gave a history of local application of any medication. Hemogram, liver function test, renal function test, bleeding time, clotting time, erythrocyte sedimentation rate, C-reactive protein, viral markers, and rheumatoid factor were found to be within normal limits in all the patients.

HTN was the most common comorbidity observed in 35 (58.3%) patients followed by DM in 19 (31.6%), dyslipidemia in 17 (28.3%), and thyroid dysfunction in 7 (11.6%) patients. The presence and the number of comorbidities in patients increased with the severity of the disease. The comorbidities were more prevalent in severe disease 24 (92.3%) followed by moderate type 15 (75%) and mild type 2 (14.2%). As per Mantel–Haenszel Chi-square for linear trend, the relative risk of comorbidity

**Figure 1:** (a) Schamberg’s disease: Pigmented and purpuric lesions involving both legs. (b) Lichen aureus: lichenoid rust-colored plaques over the ankle. (c) Majocchi’s disease: reddish brown annular patch exhibiting peripheral extension. (d) Itching purpura: eczematous purpuric patches over bilateral feet
Discussion

PPD was originally recognized as a non-inflammatory purpura without defect in platelets or vasculitis.[5] An array of etiopathogenic and aggravating factors has been proposed from time to time including venous HTN,[4] exercise,[5] gravitational dependency,[1,3] capillary fragility,[5] focal infections,[4] chemical ingestion and drugs,[2] exercise, contact allergy,[12] clothing, and alcohol ingestion.[9] A role of cell-mediated immunity has also been proposed. The classification of PPD into various types is only clinical with common histopathological features of superficial perivascular infiltrate and red blood cell extravasation without evidence of vasculitis.[8] PPD remains an understudied and enigmatic dermatosis with a lack of large-scale studies.

PPD may occur at any age, but it is commonly seen in the fourth and fifth decades of life.[2,3,6] Majority of the patients (63.3%) in our study also belonged to the fourth and fifth decades of life. The mean age of the patients was 47.37 ± 12.10 (range: 15–70) years. This is comparable with the studies conducted by Gönül et al.[9] and Kim et al.[10] where the mean age was 48.96 ± 16.80 (range: 19–82) years and 42.6 ± 19.3 (range: 13–74) years, respectively.

The disease was more common in females, which is consistent with the study conducted in Turkey by Gönül et al.[9] and in Korea by Kim et al.[10] and Cho et al.[11] but unlike the study conducted in India by Sharma and Gupta[3] in 2012, wherein males were predominantly affected. The increased female affection found in our study may be due to the increased cosmetic concern among females as compared to males.

In the present study, housewives constituted the largest group comprising 27 (45%) of the patients followed by businessmen (13.30%), bankers (11.67%), and teachers (13.30%). The disease is common among housewives probably because they are involved in routine household work which mostly involves prolonged standing and also due to increased cosmetic awareness among female gender. This is unlike the observations made by Sharma and Gupta[3] wherein the disease was more common seen among servicemen (28%), businessmen (26%), and students (24%) compared to housewives (15%).

The duration of the disease was <1 year in the majority of our patients (52%) similar to the study by Sharma and Gupta[3] and the mean duration of the disease was 14.85 ± 17.99 (median: 7) months [Table 1]. Gönül et al.[9] in their study found that the duration of disease varied from 15 days to 72 (mean ± SD: 12.15 ± 18.40) months.

Schamberg’s disease (90%) was the most common type encountered in the present study. Similar observation has been reported by Sharma and Gupta[3] (95%), Gönül et al.[9] (83.3%), Kim et al.[10] (60.5%), and Cho et al.[11] (62.2%) as well. Based on the extent of involvement, disease was found to be severe in 26 (43.3%), moderate

### Table 2: Clinical characteristics of patients with pigmented purpuric dermatosis (n=60)

| Type of PPD          | Total, n (%) | Gender, n | Site of involvement, n (%) |
|----------------------|--------------|-----------|---------------------------|
|                      |              | Male (n=28) | Female (n=32) | Feet | Ankle | Legs | Feet and ankle | Ankle and legs | Feet, ankle | Feet, ankle, legs, and other site |
| Schamberg’s disease  | 54 (90)      | 26 28     |              | 3   4 | 5   | 4   | 14 23 | 1 | |
| Majocchi’s disease   | 1 (1.67)     | 0 1       |              | 0   1 | 0   | 0   | 0   0 0 | 0 | |
| Lichen aureus        | 1 (1.67)     | 0 1       |              | 0   1 | 0   | 0   | 0   0 0 | 0 | |
| Itching purpura      | 4 (6.67)     | 2 2       |              | 0   0 | 0   | 1   | 1   2 0 | 0 | |
| PPLD                 | 0 0         | 0 0       |              | 0   0 | 0   | 0   | 0   0 0 | 0 | |
| Total, n (%)         | 60 (100)     | 28 32     |              | 3   6 | 5   | 5   | 15 25 | 1 |

PPLD: Pigmented purpuric lichenoid dermatosis of Gougerot and Blum; PPD: Pigmented purpuric dermatoses
in 20 (33.3%), and mild in 14 (23.3%) of the cases. We could not compare this observation as the severity of disease has not been studied in the existing literature.\textsuperscript{[3,9-11]}

In the present study, lower extremity was the predominant site of involvement with concomitant involvement of the feet, ankle, and legs in 25 (42.6%) and ankle and legs in 15 (25.9%) cases. Only 1 (1.67%) patient had lesion present over the trunk along with leg, feet, and ankle. These findings are in concordance with the study by Sharma and Gupta,\textsuperscript{[3]} Kim et al.,\textsuperscript{[10]} and Cho et al.\textsuperscript{[11]} However, the latter two also observed upper extremity involvement which was not seen in our study. The disease was asymptomatic in majority of the patients 54 (90%). Only 6 (10%) cases with eczematid-like purpura of Doucas and Kapetanakis complained of itching. This is similar to the observation made by Sharma and Gupta\textsuperscript{[3]} wherein itching was present in 30 (30%) cases.

The color of the skin lesions in our patients was predominantly reddish brown (41.7%) or brown (38.3%). The morphology of the lesions showed wide variation with the majority of the patients having more than one type of lesions [Table 1]. Concomitant presence of macules and purpura was the most common (33.3%) morphology. There were no details on the color and morphology of the lesions of PPD in the studies by Sharma and Gupta,\textsuperscript{[3]} Gönül et al.,\textsuperscript{[9]} Kim et al.,\textsuperscript{[10]} and Cho et al.\textsuperscript{[11]}

A history of prolonged standing as an aggravating factor was documented in 17 (28.33%) patients while 8 (13.33%) patients attributed their disease to drug intake. Since this was a cross-sectional study, the causal association between these drugs and PPD by appropriate drug modulation could not be established. Other aggravating factors observed less frequently were alcohol intake (10%), strenuous exercise (5%), and varicose vein (3.33%). In the study by Sharma and Gupta,\textsuperscript{[3]} majority of the patients (54%) were engaged in occupation involving prolonged standing. Kim et al.\textsuperscript{[10]} recorded preceding upper respiratory infection (5.3%), high orthostatic pressure due to prolonged standing (2.6%), and strenuous exercise (2.6%) as the possible etiologic factors. Cho et al.\textsuperscript{[11]} found orthostatic HTN (21.6%), exercise (8.1%), and contact with metals (2.7%) as the possible leading causes. Gönül et al.\textsuperscript{[9]} retrospectively analyzed the patch test results of patients with PPD and found 47.8% to be positive, with the most common allergen being nickel sulfate. In the same study, varicose veins were detected clinically in 20.8% cases. A close correlation between drug and purpuric reaction was documented by Nishioka et al.\textsuperscript{[14]}

Doppler ultrasonography of lower-limb veins was done in all the patients irrespective of the presence of varicose veins. Venous insufficiency was not seen in any of the patient. This is contrary to the observations made by Gönül et al.,\textsuperscript{[9]} wherein venous insufficiency was detected in 75% of the patients on Doppler ultrasonography.

The patients were offered treatment based on their symptoms and cosmetic concern. Asymptomatic patients with no cosmetic disfigurement were left untreated and advised to avoid triggering factors if any. Symptomatic and cosmetically concerned patients received treatment in the form of topical steroids, antihistamines, pentoxifylline, calcium dobesilate, rutoside, and vitamin C.

### Table 3: Types of comorbidities based on disease severity

| Comorbidity (n=60) | Total, n (%) | Mild, n (%) | Moderate, n (%) | Severe, n (%) |
|-------------------|-------------|------------|-----------------|--------------|
| DM                | 3 (5.0)     | 1 (7.1)    | 1 (5.0)         | 1 (3.9)      |
| HTN               | 10 (16.7)   | 1 (7.1)    | 5 (25.0)        | 4 (15.4)     |
| Dyslipidemia      | 2 (3.3)     | 0 (0.0)    | 1 (5.0)         | 1 (3.9)      |
| HTN + dyslipidemia| 6 (10.0)    | 0 (0.0)    | 3 (15.0)        | 3 (11.5)     |
| DM + HTN          | 7 (11.7)    | 0 (0.0)    | 3 (15.0)        | 4 (15.4)     |
| HTN + thyroid dysfunction | 3 (5.0) | 0 (0.0)    | 1 (5.0)         | 2 (7.7)      |
| DM + dyslipidemia | 1 (1.7)     | 0 (0.0)    | 1 (5.0)         | 0 (0.0)      |
| DM + HTN + dyslipidemia | 5 (8.3) | 0 (0.0)    | 0 (0.0)         | 5 (19.2)     |
| DM + HTN + thyroid dysfunction | 1 (1.7) | 0 (0.0)    | 0 (0.0)         | 1 (3.9)      |
| HTN + dyslipidemia + thyroid dysfunction | 1 (1.7) | 0 (0.0)    | 0 (0.0)         | 1 (3.9)      |
| DM + HTN + dyslipidemia + thyroid dysfunction | 2 (3.3) | 0 (0.0)    | 0 (0.0)         | 2 (7.7)      |
| None              | 19 (31.7)   | 12 (85.71) | 5 (25.0)        | 2 (7.7)      |
| Total, n (%)      | 60 (100)    | 14 (23.3)  | 20 (33.3)       | 26 (43.3)    |

1PPD severity graded as i. Mild: If only ankle and feet or <1% BSA up to ankle was involved, ii. Moderate: If ankle, feet extending up to lower one-third of the leg or ≥1% BSA confined up to lower one-third of the leg was involved, iii. Severe: If ankle, feet extending beyond lower one-third of the leg and/or distant site was involved irrespective of the BSA. HTN: Hypertension, DM: Diabetes mellitus, PPD: Pigmented purpuric dermatosis, BSA: Body surface area
The list of diseases found to be associated with PPD is long including but not limited to DM, rheumatoid arthritis, lupus erythematosus, thyroid dysfunction, hereditary spherocytosis, hematological disorders, hepatic disease, porphyria, and malignancies. Of the 60 patients, 41 (68.33%) had an associated comorbidity. The comorbidities recorded were HTN, DM, dyslipidemia, and thyroid disorders in decreasing order of frequency. The associated comorbid conditions were more prevalent in severe (92.3%) and moderate disease (75%). Only 2 (14.29%) patients with mild type of disease had an associated comorbidity. A sizeable proportion (43.33%) of patients (26/60) had more than one comorbidity with 18 (69.2%) patients in the severe group and 8 (30.7%) in the moderate group. In the study by Sharma and Gupta relatively less number of patients (6%) were found to have an associated comorbidity. Gönül et al. found comorbidities in the majority of their patients (70.8%), the most common being diabetes (23.5%). The concomitant underlying diseases observed by Kim et al. included HTN (15.8%), DM (10.5%), venous stasis (7.9%), and others (10.5%) including hyperlipidemia, atherosclerosis, rheumatoid arthritis, gout, chronic hepatitis, aplastic anemia, and depression. Cho et al. observed comorbidities in 25 (67.5%) cases, predominantly HTN (24.32%) and diabetes (8.10%). In our study, we observed that the number of comorbidities was directly proportional to the disease severity. This has not been reported previously.

Female predilection, the involvement of younger age group and prolonged standing as an aggravating factor and systemic/comorbid associations were notable findings in our patients of PPD in the present study. We argue that PPD is not that rare a disease or has a low prevalence but it is understudied, and a major hindrance to its better understanding is the lack of detailed clinico-epidemiological studies. Multicenter studies on the clinical pattern, etiological factors, and systemic associations can throw light on many other aspects of this disease.

**Conclusion**

Female predilection, involvement of younger age group, prolonged standing as an aggravating factor, and systemic/comorbid associations were notable findings in the present study. The association of PPD with various disorders, especially HTN, DM, and dyslipidemia, may not have a direct role in the pathogenesis, but they may definitely be contributory to the vascular damage as evidenced by the increasing severity of the disease with the presence of combination of various comorbidities in the present study. Although PPD is a self-limiting disease and mainly raises cosmetic concern, the dermatologist should grab the opportunity to screen PPD patients for underlying disorders. Patients with PPD, therefore, should undergo evaluation for these comorbid disorders. This will not only allow timely management of these disorders but may also have a role in limiting the progression of PPD.

**Limitations**

The study is limited by small sample size and lack of control group. Therefore, larger studies with matched control groups are further needed to validate the results.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Sherertz EF. Pigmented purpuric eruptions. Semin Thromb Hemost 1984;10:190-5.
2. Sardana K, Sarkar R, Sehgal VN. Pigmented purpuric dermatoses: An overview. Int J Dermatol 2004;43:482-8.
3. Sharma L, Gupta S. Clinicoepidemiological study of pigmented purpuric dermatoses. Indian Dermatol Online J 2012;3:17-20.
4. Ratnam KV, Su WP, Peters MS. Purpura simplex (inflammatory purpura without vasculitis): A clinicopathologic study of 174 cases. J Am Acad Dermatol 1991;25:642-7.
5. Lin WL, Kuo TT, Shih PY, Lin WC, Wong WR, Hong HS, et al. Granulomatous variant of chronic pigmented purpuric dermatoses: Report of four new cases and an association with hyperlipidaemia. Clin Exp Dermatol 2007;32:513-5.
6. Newton RC, Rainer SS. Pigmented purpuric eruptions. Dermatol Clin 1985;3:165-9.
7. Saito R, Matsuoka Y. Granulomatous pigmented purpuric dermatosis. J Dermatol 1996;23:551-5.
8. Dowd PM, Champion RH. Purpura. In: Champion RH, Burton JL, Burns DA, Breathnach SM, editors. Textbook of Dermatology. 6th ed. Oxford: Blackwell Scientific Publications; 1998. p. 2141-54.
9. Gönül M, Külcü Çakmak S, Ozcan N, Öğuz ID, Gül U, Bıyıklı Z, et al. Clinical and laboratory findings of pigmented purpuric dermatoses. Ann Dermatol 2014;26:610-4.
10. Kim DH, Seo SH, Ahn HH, Kye YC, Choi JE. Characteristics and clinical manifestations of pigmented purpuric dermatosis. Ann Dermatol 2015;27:404-10.
11. Cho JH, Lee JD, Kang H, Cho SH. The clinical manifestation and etiologic factors of patients with pigmented purpuric dermatoses. Korean J Dermatol 2005;43:45-52.
12. Engin B, Ozdemir M, Kaplan M, Mevliþþlu I. Patch test results in patients with progressive pigmented purpuric dermatosis. J Eur Acad Dermatol Venereol 2009;23:209.
13. Tristani-Firouzi P, Meadows KP, Vanderhoof S. Pigmented purpuric eruptions of childhood: A series of cases and review of literature. Pediatr Dermatol 2001;18:299-304.
14. Nishioka K, Katayama I, Masuzawa M, Yokozeki H, Nishiyama S. Drug-induced chronic pigmented purpura. J Dermatol 1989;16:220-2.