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Cutaneous diseases developed following BNT162b2 and CoronaVac vaccines

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Abstract

Although the safety of severe acute respiratory syndrome coronavirus 2 vaccines was demonstrated in clinical trials, some adverse effects have been reported after their routine use. In this study, the cutaneous reactions that developed after BNT162b2 and CoronaVac vaccines are reported. The data of 25 patients who were followed up for cutaneous adverse reactions after vaccination were compiled retrospectively. A total of 48% of the patients were female and 52% were male. The diseases detected were urticaria, leukocytoclastic vasculitis (LCV), purpuric rash, Sweet's syndrome (SS), lichenoid drug eruption (LDE), psoriasis, acneiform eruption and pigmented purpuric dermatosis (PPD). The trigger was BNT162b2 in 72% of the cases, and CoronaVac in 28%. The lesions appeared after the first dose in 64% of cases. The mean lesion onset time was 9±5.8 days. Except for the cases of PPD, LDE, and psoriasis, very little therapeutic intervention was required and was self-limited in a short time. Although post-vaccine cutaneous reactions were heterogeneous, the most common cutaneous reaction following BNT162b2 was found to be urticaria. Exacerbation of PPD, LDE, and psoriasis following CoronaVac repeat dose supported the causal association. Other cases who had repeated doses tolerated the vaccines very well.

Keywords: Sweet's syndrome, psoriasis, BioNTech BNT162b2 mRNA vaccine, COVID-19, Sinovac CoronaVac vaccine, adverse effect

1. Introduction

The World Health Organization declared coronavirus disease 2019 (COVID-19) a worldwide pandemic on March 11, 2020 (1). Vaccines were developed in record time by using new technologies, and some of these have been used worldwide from late 2020, following emergency use authorization. (1). The vaccination program in Turkey started on January 14, 2021, and BNT162b2 and CoronaVac are the most commonly used vaccines to date (2). CoronaVac (Sinovac, China) is an inactivated complete virus vaccine with aluminum hydroxide as an adjuvant (3). The vaccine developed by Pfizer-BioNTech (BNT162b2/Comirnaty, Tozinameran) is an RNA-based vaccine (4). The mRNA in the vaccine encodes the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) spike protein. The vaccine contains a number of excipients and lipids, one of which is PEG-2000. PEG-2000 is a vaccine excipient with the most allergenic potential currently known (4).

Although the safety of COVID-19 vaccines was demonstrated in phase 2 and phase 3 clinical trials, some cutaneous and systemic adverse events were reported after their routine use (5,6). The most frequently observed cutaneous side effects include local injection site reactions, urticaria, angioedema, maculopapular eruptions, exacerbation of atopic eczema, and anaphylactic reactions (6). As global mass vaccination continues, dermatologists continue to describe a wide range of cutaneous adverse reactions (7). In this study, a total of 25 cases of monocentric cutaneous reactions after BNT162b2 and CoronaVac vaccines were reported.

2. Materials and Methods

2.1. Study design and population

A cohort was formed by following the patients who applied to the Dermatology Clinic with cutaneous adverse reactions after CoronaVac and BNT162b2 vaccines in our hospital between 14 January 2021 and 1 March 2022. No cases with a history of infection or drug use that could cause skin rash were included in the series. Routine biochemical tests were performed for each patient. In all cases except urticaria, histopathological examination was performed according to standard protocols with patient consent. Systemic steroids were not preferred unless required, or minimal doses were used not to reduce the vaccine-related immune response in the treatment of the reactions. The data of 25 patients were analyzed

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retrospectively. Naranjo algorithm (>9= certain; 5-8= probable; 1-4= possible; 0= unlikely) was used for adverse effect assessment (8).

2.2. Statistical analysis

Data analyses were performed using the statistics package GraphPad Prism 7 (GraphPad Software Inc., La Jolla, CA, USA), online Socscistatistics software (https://www.socscistatistics.com/tests) and Microsoft Excel (Microsoft Corporation, Redmond, WA, USA). Percentages, mean values, and standard deviations were used for data presentation. Test for normality of data (Kolmogorov-Smirnov) was applied and based on that parametric (Student T test) and nonparametric tests (Mann-Whitney U test) were used for analysis. All correlations were measured by Pearson correlation. P–values <0.05 were considered statistically significant.

2.3. Ethical considerations

The study was approved by the Derince Research and Training Hospital Non-invasive Research Ethics Committee (2022/30). All these procedures were performed in accordance with the principles of the Declaration of Helsinki.

3. Results

Among 25 cutaneous reaction cases, 12 were female (48%), and 13 were male (52%). The mean age was found to be 44.8±16.2 (17-69) years. The mean age difference between the genders was not significant (p=0,42974, p>0.05). The trigger was BNT162b2 in 18 (72%) cases and CoronaVac in 7 (28%) cases. The diseases detected were urticaria (n=16), leukocytoclastic vasculitis (LCV) (n=1), purpuric rash (n=1), Sweet's syndrome (n=2), lichenoid drug eruption (LDE) (n=1), psoriasis (n=2), acneiform eruption (n=1) and pigmented purpuric dermatosis (PPD) (n=1) (Table 1, 2). The average time to onset of symptoms was 9±5.8 (1-21) days after vaccination. The difference in mean symptom onset time between men and women (11.25 days, 6.7 days, respectively) was significant (p=0.029188, p<0.05). Although a negative correlation was detected between age and lesion onset time, the relationship was weak (R=-0.4482, p>0.05). According to Naranjo algorithm, all of the cases were within the "probable" range.

The lesions occurred after the first dose in 16 (64%) cases, after the second dose in 6 (24%), after the third dose in 2 (8%), and after the fourth dose in 1 (4%) case. The difference in lesion onset times between the first dose and repeated doses was insignificant (p=0.240284, p>0.05). The difference between the lesion onset times was not significant according to the triggers (p=0.248759, p>0.05). During the recommended booster application period, a total of 14 (56%) patients preferred to take the reminder dose, while 11 (44%) patients avoided the application. No recurrence was detected after booster doses in any of the cases whose trigger was BNT162b2. The symptoms increased after the booster dose in PPD, LDE, and psoriasis cases whose trigger was CoronaVac, and there was no recurrence in other cases. Except for the cases that were diagnosed with PPD, LDE, and psoriasis, very few therapeutic interventions were needed and the diseases were self-limited in a maximum of 2 weeks.

3.1. Urticaria

There were 16 (64%) (8 female, 8 male) cases (case 1-16) that were diagnosed with urticaria all of whom were new-onset (Table 1). The mean age was 38.1±14 (17-69) years. The difference between the mean age of this group and the other patients was significant (p=0.001605, p<0.05). The mean lesion onset time was 10.1±6.1 (3-21) days, which was significantly higher than the other diseases detected (p=0.032199, p<0.05). The trigger was BNT162b2 in 15 (93.8%) patients and CoronaVac in 1 (6.2%) patient. Lesions appeared after the first dose in 10 cases, after the second dose in 4 cases, and after the third dose in 2 cases. Responses to 2nd generation H1 oral antihistamines were very good in all patients and intravenous steroid treatment was required in one case (case 7). No recurrence was detected in any of the 9 (56.2%) cases who had repeated doses.

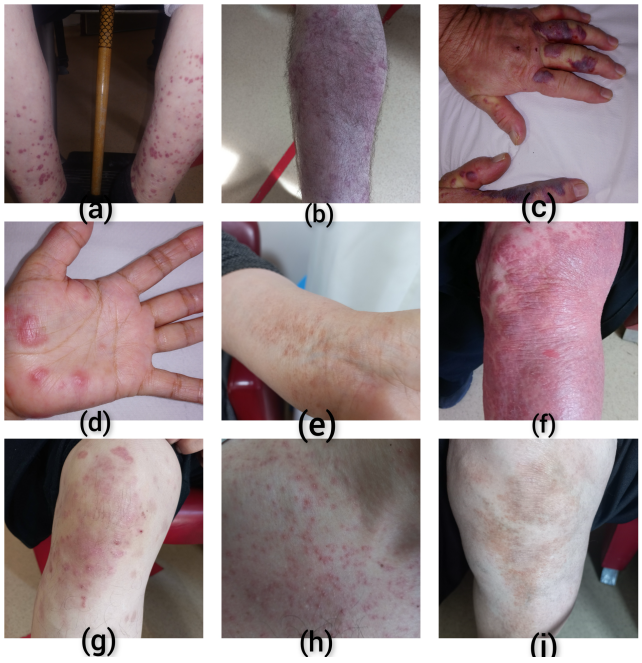

Fig. 1. Clinical images of non-urticarial cutaneous adverse events induced by COVID-19 vaccines: (a) Widespread palpable purpuric papules distributed on bilateral legs. (b) Petechiae and purpuric macules located on the right anterior lower leg. (c) Blisters of hemorrhagic content, violaceous localized on the dorsum of both hands. (d) Erythematous papules and nodules in the palm of the hand. (e) Erythematous and psoriasiform confluent papules and plaques, on the left wrist. (f) Psoriatic lesions on the extremity. (g) Psoriatic plaque localized in the knee. (h) Acneiform eruptions located on the upper chest. (i) Localized area of characteristic "cayenne-pepper" pigmentation on the leg.

Table 1. Patients diagnosed with urticaria after COVID-19 vaccines: study findings

Patient ID	Case age/sex	Causative vaccine	Onset	Vaccination status	Recurrence of lesions at repeat dose	Naranjo algoritm	Treatment	COVID-19 status after reaction
1	24/M	BNT	10 days after 1st dose	3 doses BNT	did not recur	5	OA	-
2	47/F	BNT	7 days after 1st dose	2 doses BNT	did not recur	5	OA	-
3	38/F	BNT	20 days after 2nd dose	2 doses BNT	didn't do it	6	OA	-
4	20/F	BNT	21 days after 1st dose	2 doses BNT	did not recur	5	OA	-
5	31/F	BNT	14 days after 1st dose	3 doses BNT	did not recur	5	OA	-
6	40/F	BNT	12 days after 3rd dose	3 doses (2 dose: CV, 1 dose: BNT)	didn't do it	6	OA	-
7	58/M	BNT	4 days after 2nd dose	3 doses BNT	did not recur	5	OA, SS	-
8	17/M	BNT	5 days after 2nd dose	2 doses BNT	didn't do it	6	OA	-
9	37/M	BNT	7 days after 1st dose	3 doses BNT	did not recur	5	OA	-
10	49/F	BNT	3 days after 2nd dose	2 doses BNT	didn't do it	6	OA	-
11	39/F	BNT	14 days after 1st dose	2 doses BNT	did not recur	5	OA	-
12	29/M	BNT	19 days after 1st dose	1 dose BNT	didn't do it	5	OA	-
13	69/M	CV	3 days after 1st dose	3 doses (2 dose: CV, 1 dose: BNT)	did not recur	5	OA	+ /no recurrence
14	30M	BNT	11 days after 1st dose	2 doses BNT	did not recur	5	OA	-
15	51/F	BNT	7 days after 1st dose	1 dose BNT	didn't do it	6	OA	+/ no recurrence
16	30/M	BNT	5 days after 3rd	3 dose BNT	didn't do it	6	OA	

Abbreviations: F: female, M: male, OA: oral antihistamine, SS: systemic steroid**,** BNT: BNT162b2**,** CV: CoronaVac

3.2. LCV

A 66-year-old male patient (case 17) was histopathologically and clinically diagnosed with LCV because of widespread palpable purpuric macules and papules distributed on bilateral legs starting after the first dose of the CoronaVac vaccine (Table2, Fig. 1a). The patient was under urology follow-up because of operated prostate carcinoma. The lesions regressed within 10 days with topical mometasone furoate and leg elevation. Lesions did not recur after the administration of the second dose with the same vaccine.

3.3. Purpuric rash

A 63-year-old male patient (case 18) presented with petechiae and purpuric macules located on the right anterior lower leg after the second dose of the BNT162b2 vaccine (Table 2, Fig. 1b). There were varicose veins in the left lower leg, but no varicose veins were detected in the right leg. Although there was inflammatory vascular damage in his histopathology, there was no fibrinoid necrosis or fibrin deposition on the vessel wall, and therefore, the patient was accepted as having a purpuric rash. The lesions regressed in 1 week with oral pentoxifylline (1200 mg/day) and topical mometasone furoate treatment.

3.4. SS

SS was defined clinically and histopathologically in two cases that had no previous dermatological disease or allergy (Table 2). SS was triggered by the first dose of CoronaVac in a 65-year-old male patient (case 19) and by the first dose of BNT162b2 in a 63-year-old female patient (case 20). In clinical examinations, erythematous infiltrated papules and nodules located on the palms and dorsal sides of both hands and dorsal aspects of both forearms were observed (Fig. 1c, 1d). Case 19 was being followed up in the urology unit because of benign prostatic hypertrophy. Case 20 had a history of operated breast carcinoma and no pathology was detected in the routine control 3 months ago. In both cases, fever was high and WBC, neutrophil, CRP and ESR values were above the normal range

in laboratory examinations. With topical steroid and oral prednisolone (0.5mg/kg/day), almost complete improvement was observed within 2 weeks. They did not receive the booster doses and did not have any dermatological symptoms with the COVID-19 infection they had during their follow-ups.

Table 2. Clinical and pathological characteristics of non-urticarial cutaneous adverse events induced by COVID-19 vaccines

Patient ID	Age /sex	Diagnosis	Skin biopsy	Causative vaccine	Onset	Number of dose	Recurrence status	COVID-19 status after reaction	Naranjo algoritm
17	66/M	LCV	Perivascular and interstitial neutrophilic infiltrate with leukocytoclasia and fibrin deposition in vessel walls	CV	11days after 1st dose	2 doses CV	did not recur	-	5
18	63/M	Purpuric rash	Orthokeratosis on the surface, reduction in granular layer, irregular mild acantholysis, slight increase in the number of basal pigment and rare neutrophils. Oedema of the papillary dermis, dense perivascular and periadnexal neutrophilic and lymphohistiocytic infiltration, no fibrin was identified	BNT	1 days after 4 th dose	2 doses CV, 2 dosesBNT	didn't do it	-	5
19	65/M	SS	Hyperkeratosis, spongiosis, upper dermal oedema and extravasation of red cells, significantly dense neutrophilic cell infiltration extending into the upper, middle, and lower dermis and sparse eosinophils, dilated vessels, perivascular neutrophil infiltration, vasculitis	CV	3 days after 1st dose	1 dose BNT	didn't do it	+	5
20	63/F	SS	Hyperkeratosis, mild oedema of papillary and upper dermis, neutrophilic and lymphocytic inflammation in the dermis, perivascular inflammation, focal fibrinoid necrosis	BNT	4 days after 1st dose	1 dose BNT	didn't do it	+	6
21	53/F	LDE	Hyperkeratosis, focal hypogranulosis, acanthosis, irregular psoriasiform hyperplasia, cytoid body, intraepidermal lymphocyte exocytosis, perivascular lymphohistiocytic infiltration involving the basal layer of the epidermis	CV	14 days after 2nd dose	3 doses CV	repeated	-	6
22	52/F	Psoriasis	Hyperkeratosis, parakeratosis, elongation of epidermal rete ridges, munro microabscesses, papillary dermal oedema, dilatation of capillaries, focal perivascular inflammation	CV	14 days after 1st dose	2 doses CV	repeated	-	7
23	62/M	Psoriasis	Orthokeratosis on the surface, epidermal acanthosis with psoriasiform pattern, slight spongiosis, neutrophils in the keratin layer, hypogranulosis, ectatic-looking vessels in the dermal papillae	BNT	7 days after 2nd dose	3 doses BNT	did not recur	-	5
24	25/M	Acneiform eruption	Orthokeratosis on the surface, epidermal spongiosis, irregular acanthosis, dermal oedema, neutrophil leukocytes and lymphohistiocytic infiltration eosinophilic rich around the swollen blood vessels and in the interstitial space in the superficial and mid dermis	CV	4 days after 1 st dose	1 dose CV	didn't do it	-	6
25	62/F	PPD	Slight spongiosis, modest perivascular lymphohistiocytic infiltrate, scarce presence of melanophages in the papillary dermis, focal erythrocyte extravasation, endothelial cell swelling seen, no fibrin was identified	CV	5 days after 1 st dose	2 doses CV	repeated	+	6

Abbreviations: F: female; M: male, LCV: leukocytoclastic vasculitis, SS: Sweet's syndrome, LDE: lichenoid drug eruption, PPD: pigmented purpuric dermatosis, CV: CoronaVac, BNT: BNT162b2

3.5. LDE

A 53-year-old female patient (case 21) who had no previous history of systemic or dermatological disease presented with erythematous and psoriasiform confluent papules and plaques, on the left wrist, both legs, and lower abdomen after the second dose of CoronaVac vaccine (Table 2, Fig.1e). The patient was diagnosed clinically and histopathologically with LDE developing after the CoronaVac vaccine. Classical Wickham striae were not present. The lesions regressed almost completely in 1 month with oral antihistamine and topical steroids. The lesions appeared more severely after the third dose of the CoronaVac vaccine. Almost complete recovery was achieved with oral methylprednisolone (0.5mg/kg/day) treatment that lasted for 3 weeks, but in 2 weeks following the cessation of the treatment, the lesions revived, acitretine (25mg/day) was started and the treatment continues.

3.6. Psoriasis

New-onset psoriasis, which was confirmed histopathologically in two cases who did not suffer from any previous skin reaction, was defined (Table 2). The lesions developed after the first dose of the CoronaVac vaccine in a 52-year-old female (case 22, Fig. 1f) patient and after the second dose of the BNT162b2 vaccine in a 62-year-old male patient (case 23, Fig. 1g). The estimated psoriasis area and severity index (PASI) score was 11 and 15, respectively. Case 23 had diabetes mellitus and Parkinson's disease. The female patient was followed up with topical treatment, and the male patient with topical treatment and acitretine (25mg/day). The lesions were exacerbated after the second dose of CoronaVac administration in the female patient. In the male patient, there was no increase in the lesions with the BNT162b2 booster dose 6 months later. PASI scores were calculated as 5 and 3, respectively six months later.

3.7. Acneiform eruption

Acneiform eruptions without comedones developed on the anterior and posterior upper chest four days after CoronaVac vaccination in a 25-year-old male patient (case 24) (Table 2, Fig. 1h). The lesions regressed with fusidic acid (1000 mg/day) and topical benzoyl peroxide within 2 weeks, leaving postinflammatory hyperpigmentation. The patient did not repeat the vaccine dose.

3.8. PPD

A 62-year-old female patient (case 25) was diagnosed with PPD, which was also confirmed histopathologically, because of nonpruritic, "cayenne pepper"-like macular lesions on bilateral lower extremities (Table 2, Fig.1i). The lesions started after the first dose of the CoronaVac vaccine and intensified with the second dose. There were no varicose veins and edema in the lower extremities in the examination. The lesions disappeared in 1.5 months with topical betamethasone treatment. The patient had a COVID-19 infection in her follow-up, which did not cause an increase in disease activation.

4. Discussion

COVID-19 vaccines might cause exacerbation of pre-existing dermatosis as well as new-onset cutaneous adverse drug reactions (9). In general, the immunological mechanisms underlying the cutaneous reactions following immunization are not fully understood (10). They might be induced by excipients acting as preservatives, stabilizers, or adjuvants as well as associated with the active drug (4,10,11). Immunogenic effects of vaccines may cause changes in chemokine and cytokine levels, and therefore, cutaneous reactions depending on the predominant cutaneous inflammation type (9). Accordingly, different patterns of inflammatory skin reaction can be differentiated (9,12).

In the present study, the cutaneous adverse reactions developed after CoronaVac and BNT162b2, which were followed up and treated, were compiled. The diseases detected were urticaria, LCV, purpuric rash, SS, psoriasis, LDE, PPD, and acneiform eruption. All of the diseases in the series were new-onset. The probability assessment scale according to Naranjo algorithm was in the "probable" range for all cases. In a systematic review of cutaneous adverse reactions to COVID-19 vaccines, lesion onset ranged from 1 to 21 days after vaccination (13). In the study, the lesion onset time of all cases was within this range. Additionally, its average was similar to the study of Niebel et al. (9±5.8 days) (14).

Although some studies reported that the reactions were predominantly female, the cohort presented here was predominantly male (52%). Also, lesion onset time was earlier in men than in women ($p<0.05$). In a study in which the data of 11 cases were compiled, cutaneous reactions were reported to occur in 81% of patients after the second dose (15). On the contrary, it was found here that 64% occurred after the first dose.

BNT162b2 (93.8%) was the most common trigger in the 16 (64%) (case 1-16) patients who had a diagnosis of urticaria, which was associated with the vaccine. According to McMahon et al (16), urticaria was the most common of the 71 dermatological reactions occurring after the BNT162b2 vaccine. Farinazzo et al (17) and our report also support this. Although the lesion onset time of the urticaria patients was later in the present study than that of other patients ($p<0.05$), the mean age was younger ($p<0.05$). Among the 18 patients who reported urticaria after the first dose of Pfizer and Moderna mRNA vaccines, 4 (22%) had recurrences after the second dose (16). Relapse was reported after the second dose in 4 of 7 patients who developed urticaria after CoronaVac (3). On the contrary, no recurrence was detected in the follow-up of any of the cases who received or did not receive the booster dose. The response to oral antihistamines was quite good and self-limited in a short time after treatment. Previous reports support that the prognosis is quite good (3,16,17). For this reason, repetitive applications with the same vaccine should not be limited in this group.

There are several case reports showing LCV development after the Moderna, Oxford–AstraZeneca, BNT162b2, and CoronaVac SARS-CoV-2 vaccines (15,18-20). Similarly, CoronaVac -induced cutaneous LCV and BNT162b2-induced purpuric cutaneous lesion cases (case 17 ve 18) were detected here. Case 18 had petechiae and non-palpable purpuric lesions involving only the anterior aspect of the right lower leg, and there was no fibrinoid necrosis, although there was inflammatory vascular damage in his histopathology. We followed the patient with purpuric rash. This patient tolerated 2 doses of CoronaVac and 1 dose of BNT162b2 quite well before the lesion. In the patient with LCV, no recurrence was detected after the second dose of CoronaVac. The response to treatment was very good in both patients. Since vascular lesions show a good prognosis after the vaccination, they are not considered a contraindication to vaccination by authors (21).

Another disease detected was SS. In the literature, there are three reports of SS after mRNA-based SARS-CoV-2 vaccine and two after adenovirus-based SARS-CoV-2 vaccine (1,22-25). There is no evidence yet of SS following CoronaVac vaccine. One of the cases included in the present study had lesions after CoronaVac and the other after BNT162b2 vaccine (case 19,20). Both met all five diagnostic criteria recommended by Walker and Cohen (26) for drug-induced SS. In the literature, onset times for skin findings range from 24 hours to 7 days (24,25). In the cases included here, the lesions started on the 3rd and 4th days following the vaccination. The response to the treatment was quite good in both of them. No skin reactions developed after the COVID-19 infection during their follow-ups. Our cases did not have a booster dose, and there is no data on the recurrence with dose repetition in other reported cases.

In the present study, LDE after CoronaVac vaccine was described in a 53-year-old female patient who had no history of skin disease in her past. To the best of our knowledge, there are 8 cases of LP/LDE, two of which were CoronaVac -related, secondary to the COVID-19 vaccine (27-30). Contrary to classical LP, classical Wickham striae are not seen in LDE, as in the case presented here (27). No eosinophilia was detected in the histopathology of our case. Although eosinophils are considered a “diagnostic clue” in LDE, the absence of eosinophils does not exclude drug eruption (31). No revival of the lichenoid eruption was identified because the repeated application was not performed in the reported cases. The lesions of our patient regressed completely after the treatment, but the rashes returned more severely after the 3rd dose of CoronaVac vaccine and it was very difficult to control after this stage. For this reason, other options for booster doses can be tried in patients who develop a lichenoid rash after CoronaVac.

Although mostly existing psoriasis exacerbations were reported in the literature with SARS-CoV-2 vaccine types, a few new-onset cases were also reported (14,16,32,33). Similarly, new-onset psoriasis was described in the present study after CoronaVac and BNT162b2 vaccination, respectively, in a 52-year-old female and a 62-year-old male patient who did not suffer from any previous skin reactions. Most of the 14 psoriasis patients who experienced exacerbation after the first dose also experienced exacerbation after the second dose (34). Although the lesions of our female patient increased with the booster dose of the CoronaVac vaccine, no exacerbation was detected in the male patient with BNT162b2. The temporal correlation between the COVID-19 vaccine and the development of psoriasis and the lack of other triggers reinforce a possible causal relationship. For this reason, here, we hypothesize that COVID-19 vaccines might cause the activation of inflammatory pathways, which may lead to the onset or exacerbation of psoriasis.

A 25-year-old male patient developed acneiform eruption after the CoronaVac vaccine. The disease was self-limited within 2 weeks of treatment. Rerknimitr et al. (35) described 3 cases of acneiform eruption after 29907 CoronaVac injections. No other data on this subject has been found in the literature.

PPD that started after the CoronaVac vaccine in a 62-year-old female patient with no previous history of skin disease was detected. To the best of our knowledge, there are 3 cases of PPD reported having developed secondarily to the BNT162b2 mRNA COVID-19 vaccine in the literature (18,36,37). There is no evidence of PPD yet following CoronaVac vaccine. It was argued that immune cross-reactivity and hypersensitivity to vaccine components of the BNT162b2 vaccine might cause PPD by leading to endothelial damage and erythrocyte extravasation (37). In the reported cases, no recurrence was reported in the lesions after dose repetition (37). In our case, the lesions intensified following the second dose. For this reason, we believe that it would be the right approach to change the vaccine preference for booster doses in patients who have a history of PPD following CoronaVac vaccination.

This study is retrospective and represents patients from a single center. Although the temporal relationship and high probability according to Naranjo algorithm support associations with the vaccine, the causality cannot be determined exactly, it can only be associated. The fact that no histopathological examinations were performed in cases diagnosed with urticaria did not allow us to obtain common histopathological evidence. The retrospective fashion of the study did not allow us to analyze the serological response and anti-SARS-CoV-2 antibody responses for SARS-CoV-2 at the time of vaccination. However, none of the patients had symptoms that were compatible with COVID-19 infection.

With this study, the purpose was to raise awareness of the possibility of new-onset dermatoses secondary to CoronaVac and BNT162b2 vaccines. The misinterpretation of post-vaccine cutaneous reactions may prevent some patients from taking their booster doses wrongfully. We think that the present study will contribute to the management of cutaneous adverse

reactions. The characterization and systematic monitoring of such reactions will enable the publication of an evidence-based algorithm for safe vaccine administration in the future.

In the present study, the diversity of possible cutaneous inflammatory reactions after CoronaVac and BNT162b2 vaccines was emphasized. Although post-vaccine cutaneous reactions are heterogeneous, it was noted that the most common cutaneous skin reaction after BNT162b2 was urticaria. The prognosis in urticaria and vascular lesions was quite good, and dose repetitions were very well tolerated. The exacerbation observed following the booster doses in patients who developed PPD, LDE, and psoriasis after the CoronaVac vaccine supported the causal link. For this reason, it is recommended that different agents be preferred in dose repetitions in these three diseases.

In conclusion, we would like to emphasize that the incidence of cutaneous side effects is quite low when compared to the number of vaccines, and cutaneous reactions necessitate very few therapeutic interventions or are self-limiting, and therefore, BNT162b2 and CoronaVac vaccines have satisfactory safety profiles.

Conflict of Interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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Informed consent forms were obtained from all patients whose photographs were used.

Authors' contributions

Concept: F.Y.B., Design: F.Y.B., Data Collection or Processing: F.Y.B., Analysis or Interpretation: F.Y.B., Literature Search: F.Y.B., Writing: F.Y.B.

Ethical Statement

The study was approved by the Derince Research and Training Hospital Non-invasive Research Ethics Committee (2022/30). All these procedures were performed in accordance with the principles of the Declaration of Helsinki.

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