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Cutaneous Manifestations of COVID-19: A Descriptive Analysis of a Southeastern USA Purposive Sample

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ABSTRACT

This study describes characteristics and factors associated with cutaneous manifestations of COVID-19 encountered across acute inpatient, and critical care units in a large Southeastern USA public hospital from March 1, 2020, through November 01, 2021. A retrospective descriptive analysis was conducted on a purposive sample of patients consulted for non-pressure injury related cutaneous wounds while positive for COVID-19. Patients were predominantly male (64.3%, $n = 27$), White (66.7%, $n = 28$) and Black (33.3%). No cutaneous wounds while positive for COVID-19 were observed for Hispanic patients. Patient mortality was 71.4% ($n = 30$). Gender distribution was proportionate by gender (67% were male) and race (65.5% were White) for deceased patients. Body mass index (BMI) ranged from 15.8 to 61.2 with a mean of 31.9 (SD = 10.76) and median BMI 28.7. Identification of cutaneous manifestations of COVID-19 and understanding of the retiform purpura pathophysiology could prove useful in guiding COVID-19 treatment regimens. Investigation into factors preventing complement cascading in those of Hispanic ethnicity may be useful in the prevention of CMC-19 and progression of severity of illness.

1 | Background

In December 2019, Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV-2) was identified in Wuhan China. This newly identified pathogen, transmitted through respiratory droplets, was primarily associated with interstitial pneumonia and respiratory failure when the World Health Organization declared the 2019 corona virus disease (COVID-19), a global pandemic in March of 2020 [1]. Lesser-known cutaneous manifestations of the disease began to emerge prompting calls for further investigation in the Fall of 2020 [2].

Dermatological encounters with cutaneous manifestations of COVID-19 (CMC-19) were observed globally and across all age groups during the pandemic, continuing into this endemic

period [3–5]. Common categorical classifications of CMC-19 include, viral exanthem/rash, vesicular, uticular, chilblains/chilblains-like, other non-chilblain vasculopathy-related, erythema, pityriasis rosea-like, multiforme-like and Kawasaki/Kawasaki-like disease [3–10]. Cutaneous reactions also are reported with COVID-19 vaccination and can be immediate or delayed [5].

Clinical case reports, case series, literature reviews and purposive samples were analysed from diverse global sources [3–21] and types of cutaneous eruptions were classified with 23 unique types of cutaneous presentations reported, 16 of which are less common and seven, which are more frequently encountered [15]. The three most commonly reported cutaneous manifestations included vesicular rash, chilblain-like lesions

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Summary

- Identification of cutaneous manifestations of COVID-19 and understanding of the retiform purpura pathophysiology could prove useful in guiding COVID-19 treatment regimens.
- This study describes characteristics and factors associated with cutaneous manifestations of COVID-19 in a Southeastern USA public hospital from March 1, 2020 to November 01, 2021. Microsoft Excel for Microsoft 365 MSO version 2404 and SPSS version 25.0 were used for analysis.
- Patients were predominantly male (64.3%, $n=27$), White (66.7%, $n=28$) and Black (33.3%). No Hispanic patients exhibited cutaneous wounds while positive for COVID-19. Patient mortality 71.4% ($n=30$) was proportionate by gender (67% were male) and race (65.5% were White).

on the extremities, and a retiform purpura lesion excluded from pressure injury criteria due to the lack of presence of a bony prominence [2, 15]. Chilblain-like manifestations appearing on the extremities, commonly referred to as 'COVID toes', are correlated with cases where disease course is less severe or the patient asymptomatic [4]. The vesicular rash, commonly referred to as COVID rash usually appears at the onset of the virus or with viral reactivation and is associated with a more moderate disease course [21, 22]. However, the retiform purpura lesion, most frequently found on the sacrum or buttocks, is associated with cases where severity of COVID illness and risk of mortality is high [15].

Dermatological patterns of COVID-19 cutaneous manifestations can be classified into two categories: (1) inflammatory reactions such as uticular, vesicular and maculopapular/morbilliform rashes and (2) vascular associated lesions such as purpura/pe- techia, chilblain-like rashes, livedo racemosa-like patterns [4]. Researchers further confirm the pathophysiological process of COVID skin manifestations is distinctly different between less severe associated cutaneous manifestations and in severe cases with retiform purpura [23, 24].

The purpose of this study is to describe characteristics and factors associated with CMC-19 encountered by an interpro- fessional skin team consisting of a physician, advance practice nurses and 12 member wound nursing team across the acute inpatient, and critical care units in a large Southeastern USA public hospital from March 1, 2020 to November 01, 2021.

2 | Methods

2.1 | Design

We designed a retrospective descriptive study utilising purpo- sive sampling to evaluate patients with cutaneous manifesta- tions of skin injury occurring during the COVID-19 pandemic. Variables collected include demographic variables such as age,

race, gender, ethnicity, height, weight, zip code, along with co-morbid conditions and comorbid complications (such as encephalopathy, renal failure, myocardial infarction). Date of onset of COVID-19, co-occurring COVID-19 symptoms and date of onset of COVID-related skin changes, skin event lo- cation using body map with 54 distinct zones were recorded. The variables wound type, wound description, wound mea- surements, date of wound resolution, risk of mortality, date of discharge, severity of illness, date of death and cause of death were also recorded. Co-morbid conditions and co-occurring COVID-19 symptoms were recoded into larger disease cate- gories during analysis.

2.2 | Setting

The project site was an urban academic health science centre in the southeastern USA. The hospital has 1207 licensed beds, exceeds 55000 admissions annually, and conducts over 6000 ambulatory visits daily. It is the third largest public hospital in the USA and a five-time American Nurse Credentialing Center Magnet designated facility 2002 to present.

2.3 | Participants

Retrospective data analysis includes all participants meeting the following inclusion criteria: adults 19 years of age or older, with CMC-19, regardless of age, race or gender who received wound consultation ($n=42$).

2.4 | Inclusion/Exclusion Criteria

Patients meeting the criteria for inclusion in the EHR review were COVID-19 positive adults, identified as receiving an inpa- tient wound consult for COVID related skin changes between March 1, 2020 and November 1, 2021. Exclusion criteria con- sisted of patients who were diagnosed by a wound care provider as having skin injury or disease not related to COVID-19, pa- tients without confirmed diagnosis of SARS-Co-V-2, or patients admitted after November 01, 2021.

2.5 | Data Collection and Analysis

When all IRB and compliance standards were met, an organisa- tional data steward created a limited patient worklist. Worklist E-HR patient list access was provided for the reviewer for the retroactive period only, consisting solely of study patients. Retrospective data were gathered through chart audit, by the principal investigator. Data were de-identified, entered into an electronic spreadsheet file and stored on an encrypted drive stored securely by the principle investigator. Analysis was con- ducted using Microsoft Excel for Microsoft 365 MSO version 2404 [25] and SPSS Version 25.0 [26]. Descriptive statistics con- sisting of mean, median, mode, standard deviation, frequency, cross correlation tabulations and X^2 were completed. A second- ary hand audit was conducted to verify lack of presence of reti- form purpura among patients with Hispanic ethnicity.

2.6 | Ethical Compliance

This study was granted exempt Category 4 status. All data from this study were de-identified, stored and disposed of according to HIPAA and Institutional Review Board requirements.

3 | Results

A total of 42 patients were analysed. The mean age of the CMC-19 sample is 64.7 years old (SD = 15.12), range from age 27 to 95 years (span of 68 years). Demographic attributes by gender, race, ethnicity and overall mortality are available in Table 1. Comorbid conditions among patients are reported in Table 2. Risk of mortality and severity of illness are reported in Table 3.

4 | Discussion

Many participants were male (64.3%, $n=27$), White (66.7%, $n=28$) and the remaining identified their race as Black (33.3%). Mortality among patients totalled 71.4% ($n=30$). Gender distribution was proportionate by gender (67% were male) and race (65.5% were White) for deceased patients. Body mass index (BMI) ranged from 15.8 to 61.2 with a mean of 31.9 (SD = 10.76) and median BMI of 28.7.

Patient zip codes were collected to provide a cursory look at possible trends among patients with regard to socioeconomic status by geolocation. Only two ($n=2$) of the 42 patients shared the same zip code with the remaining billing zip codes being unique to each patient ($n=40$) and all geographically located within one state.

5 | Type and Site of Injury

The wound care team reported skin lesion as the most frequently documented type of CMC-19 (92.9%, $n=39$) Of the patients screened by the wound care team. Only 4.8% of patients ($n=2$) were confirmed as having a COVID rash, and the remaining patient (2.3%, $n=1$) was the only confirmed case of co-occurring rash and lesion. Lesions were identified as originating in 12 distinct locations among CMC-19 patients ($n=40$) with confirmed lesions. The highest frequency of lesions occurred across three body locations (Figure 1) with location 38, left buttock ($n=18$), the most prevalent point of origin, location 46, sacrum ($n=8$), the second most prevalent location of origin and location 39, right buttock ($n=4$), the third most prevalent location of origin. The remaining nine locations only had single instances of lesions. Figure 2 maps the prevalence of CMC-19 spread across locations of the body.

TABLE 2 | Comorbid conditions by category in COVID-related skin injury patients.

Attribute	Frequency	<i>n</i>	Percent
Comorbid condition			
Cardiovascular	30	42	71.4
Diabetes	22	42	52.4
Respiratory	5	42	11.9
Neurocognitive	9	42	21.4
Gastrointestinal	1	42	2.4
BMI > 30	5	42	11.9
Renal	5	42	11.9

TABLE 1 | Frequency of characteristics of cutaneous manifestations of COVID-19 in southeastern USA patients.

Variable	All admissions			COVID skin injury		
	All (N= 93 437)	COVID-19 diagnosis		All (n = 42)	Mortality	
		No (n = 87 547)	Yes (n = 5890)		No (n = 12)	Yes (n = 30)
Gender						
Male	44 735 (47.9%)	41 825 (47.8%)	2910 (49.4%)	27 (64.3%)	6 (22.2%)	21 (77.8%)
Female	48 701 (52.1%)	45 721 (52.2%)	2980 (50.5%)	15 (35.7%)	6 (40.0%)	9 (60.0%)
Race/ethnicity						
Black or African American	34 274 (36.7%)	31 746 (36.3%)	2529 (42.9%)	14 (33.3%)	4 (28.6%)	10 (71.4%)
White	53 111 (56.8%)	50 258 (57.4%)	2853 (48.4%)	28 (66.7%)	8 (28.6%)	20 (71.4%)
Hispanic	2675 (2.9%)	2456 (2.8%)	219 (3.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Asian	1490 (1.6%)	1352 (1.5%)	138 (2.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Native American/ Alaska Native	127 (0.1%)	119 (0.1%)	8 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Unknown	1745 (1.9%)	1602 (1.8%)	143 (2.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

TABLE 3 | Severity of illness (SOI) and risk of mortality (ROM) in southeastern USA patients with cutaneous manifestations of COVID-19.

Variable	Total (N=42)	Alive (n=13)	Death (n=29)
SOI			
Major	4 (9.52%)	2 (15.38%)	2 (6.90%)
Extreme	36 (85.71%)	10 (76.92%)	26 (89.66%)
Missing	2 (4.76%)	1 (7.69%)	1 (3.45%)
ROM			
Minor	1 (2.38%)	1 (7.69%)	0 (0.00%)
Moderate	1 (2.38%)	0 (0.00%)	1 (3.45%)
Major	5 (11.90%)	2 (15.38%)	3 (10.34%)
Extreme	33 (78.57%)	9 (69.23%)	24 (82.76%)
Missing	2 (4.76%)	1 (7.69%)	1 (3.45%)

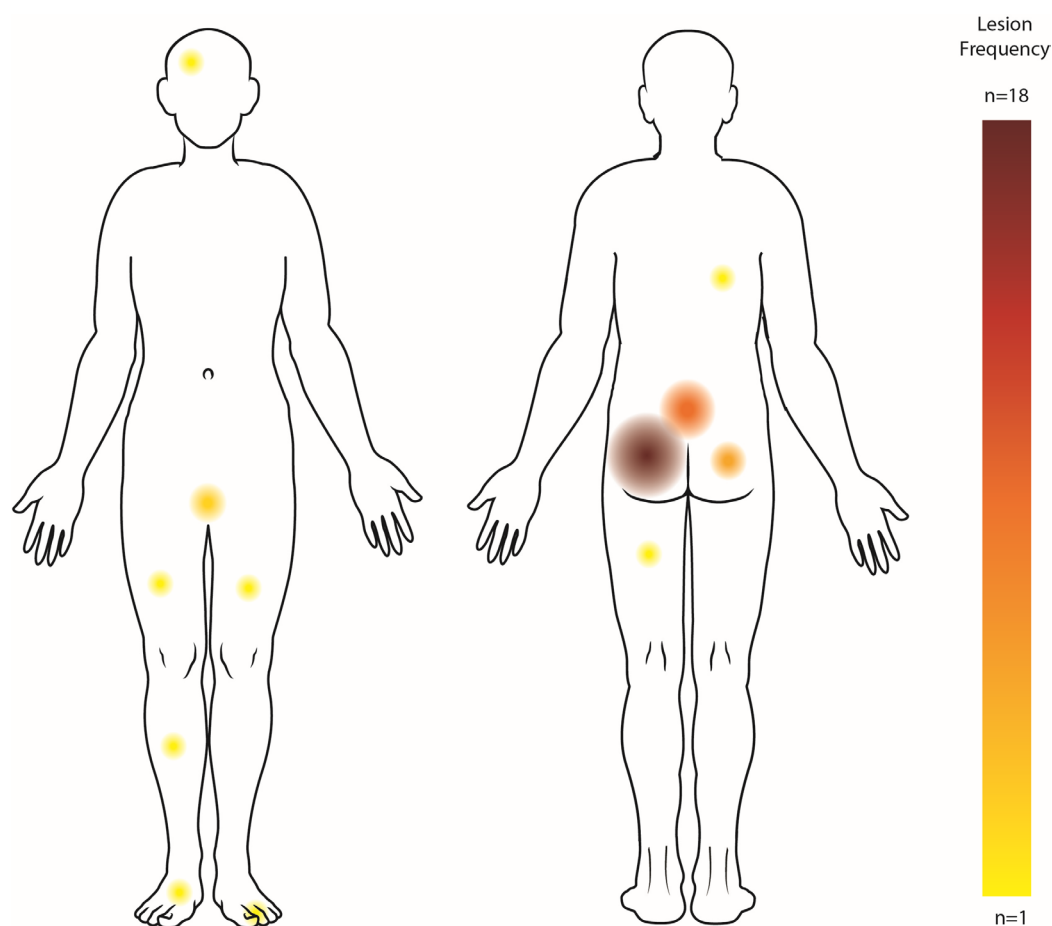


FIGURE 1 | Cutaneous manifestations of COVID-19: Location of origin.

This study supports findings in previous studies that link the presence and pathology of retiform purpura to increased severity of disease course [23, 24]. Correlations between skin eruptions, such as the disease course of vesicular rash ($n=2$), being a predictor of moderate COVID-19 severity and an early warning sign of viral activity [5, 21, 22] and chilblain-like COVID lesions ($n=0$) and being indicative of lesser severity of illness (SOI), are supported by findings in the literature.

Overall inpatient admissions for patients requiring hospitalisation for acute and critical care of COVID-19 were 5890 (6.30%) during the period of March 1, 2020 to November 01, 2021. Overall admissions of Hispanic patients requiring hospitalisation for COVID-19 treatment were 3.7% ($n=219$). No patients of Hispanic ethnicity were identified with cutaneous manifestations of COVID-19. These results are similar to studies across 25 Latin countries where retiform purpura was only present 0.04%, 2/995 patient cases [19].

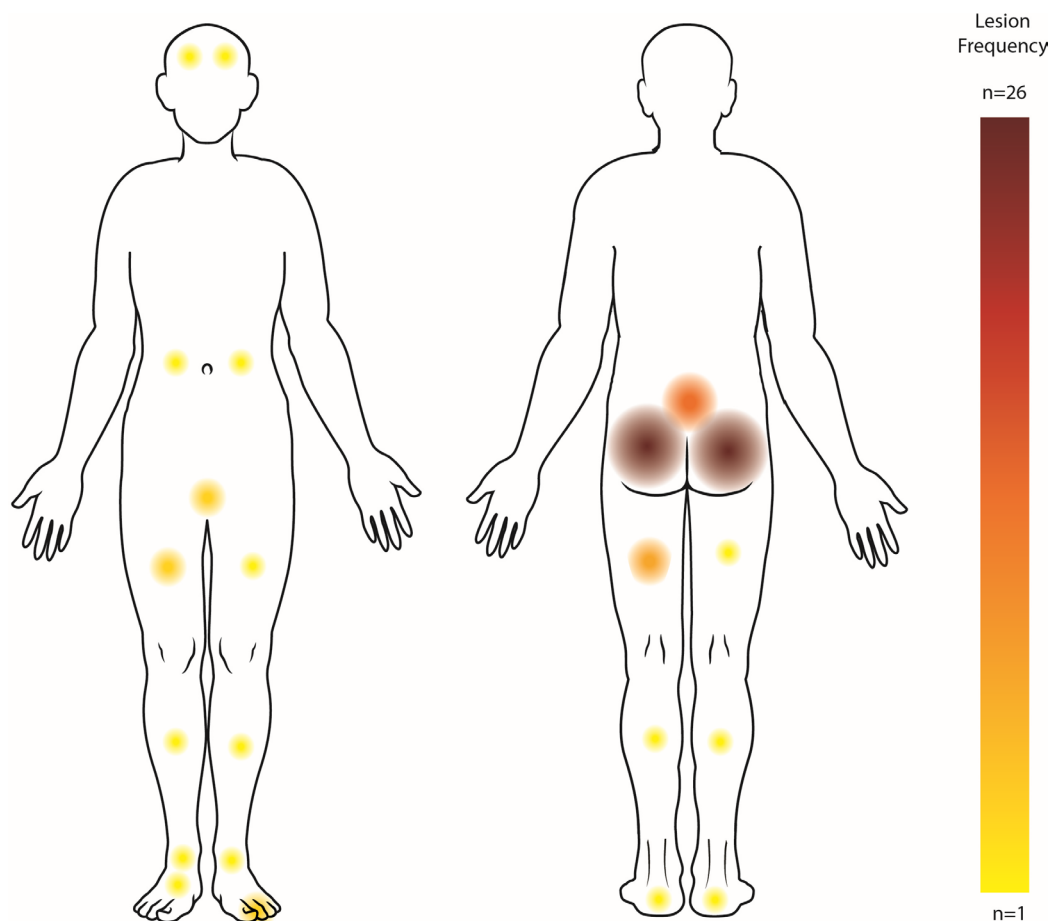


FIGURE 2 | Cutaneous manifestations of COVID-19: All incidences.

6 | Limitations

This study was a purposive sample of patients seen for wound consults during the pandemic and was not inclusive of all patients who could have had CMC-19. Due to unfamiliarity with the emergent condition, skin eruptions could have been mistaken for other conditions or missed in skin with darker skin tones. Due to staffing shortages, temporary workers or burdened staff may have been unfamiliar with the wound consultation reporting process, thus potentially decreasing sample size. Descriptive analysis was negatively impacted by a lack of wound measurements and charting.

7 | Conclusions

7.1 | Practice Implications

Identification of CMC-19 and understanding of the pathophysiological processes creating retiform purpura could be useful in guiding treatment regimens for those presenting with eruptions. Investigation into the factors preventing complement cascading in those of Hispanic ethnicity may be useful in the prevention of CMC-19 and progression of SOI [19, 27]. Lack of wound

measurements and charting limited ability to provide descriptive analysis.

7.2 | Recommendations

Dissemination of updated findings related to CMC-19, pathophysiology underlying types of wounds, and identification of CMC-19 across all skin types should continue due to the ongoing endemic presence of COVID-19. Meta-analysis of cutaneous findings among those of Hispanic ethnicity [19, 27] should continue and investigation of possible complement cascade protective factors warrant consideration in that it may translate to decreasing severity among all ethnicities.

Ethics Statement

This study, record number 300007268, was declared to be exempt category 4 by the University of Alabama at Birmingham Institutional Review Board and meets all ethical requirements.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Access to our data set is not available per institutional policy.

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