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Factors affecting the incidence and prevalence of pressure ulcers in COVID-19 patients admitted with a Braden scale below 14 in the intensive care unit: Retrospective cohort study

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Abstract

The pandemic of coronavirus (COVID-19) has significantly increased the admission of patients with extensive complications, especially for respiratory support, to intensive care units (ICUs) worldwide. These patients also suffer from pressure ulcers (PUs) as another complication that occurs due to increased length of hospitalisation and acute conditions of patients. Therefore, this study aimed to evaluate the incidence and prevalence of PU and the factors affecting it in COVID-19 patients admitted to ICUs. This cohort retrospective study used registry data in Imam Reza Hospital located in west of Iran. Four hundred and forty-five COVID-19 patients older than 20 years hospitalised in corona ICUs from 20 March 2020 to 30 December 2020, with a Braden score of less than 14 were included in the study. To investigate the relationship between variables in rate prevalence, univariate logistic regression analysis was used to calculate odds ratio, and for incidence rate in estimating PU risk generated in ICUs, hazard ratio was calculated using cox regression. One hundred and eighty-three (41.12%) patients were male. The mean age of patients was 63 (SD = ±9.78) years. A total of 1152 cases of PU were generated, with the highest prevalence of PU with 234 cases in the sacrum. One hundred and seventy-six (55.87%) patients underwent non-invasive ventilation ulcers. The prevalence of PU was 79.7%. The highest prevalence was found in people over 80 years with 90.67%. The incidence ratio was 46.74%. The highest number of new cases was seen in diabetic patients with 60.96%. First-degree ulcers were the most common degree of ulceration in 252 (55.38%) patients. Incidence and prevalence excluding first-degree wounds were 24.04% and 49.66%, respectively. Age, Braden score, BMI, comorbidity, diabetes mellitus, stool incontinence, Glasgow coma scale, vasopressor, and length of hospital stay were significantly associated with PU ($P < .05$). The incidence and prevalence

of PU in patients were high in this study. The length of hospitalisation and Braden score were the most important factors in the development of PU. The widespread prevalence of COVID-19 and the relatively long stay of patients in the ICU created unfavourable conditions for patients and the treatment system, therefore, it emphasised the use of appropriate measures to prevent PU to avoid double costs and longer stays.

KEYWORDS

Braden scale, COVID-19, pressure ulcers, wound degree

Key Messages

- the pandemic of coronavirus (COVID-19) has significantly increased the admission of patients with extensive complications, especially for respiratory support, to intensive care units (ICUs) worldwide
- these patients also suffer from pressure ulcers (PUs) as another complication that occurs due to increased length of hospitalisation and acute conditions of patients
- the incidence and prevalence of PU in patients were high in this study
- the length of hospitalisation and Braden score were the most important factors in the development of PU
- the widespread prevalence of COVID-19 and the relatively long stay of patients in the ICU created unfavourable conditions for patients and the treatment system

1 | INTRODUCTION

The coronavirus (COVID-19) pandemic has caused hospitalisation of patients worldwide with a wide range of clinical complications for a variety of reasons. The most important complication of COVID-19 in hospitalised patients is acute respiratory distress syndrome, which requires patients to use oxygen supply equipment such as a ventilator and a non-invasive ventilation (NIV) mask.[1] COVID-19 patients admitted to the hospitals, especially the intensive care units (ICUs), are prone to pressure ulcers (PUs) as an important and double complication due to multiple complications of the disease such as inactivity, and some degree of immobility and the use of artificial airways.[2] On average, during the corona pandemic in different countries of the world, COVID-19 patients occupy 21% of the ICU admission capacity with an average [95% CI = 6.99-8.63] 7.78 days per patient.[3] Increasing the length of hospital stay[4] causes PU and PU, in turn, increases LOS. PU, also called pressure sores or bedsores, causes injuries to the skin and underlying tissue that appear primarily due to prolonged pressure on the skin due to inactivity and factors such as age over 65.[5] In particular, second- and higher-grade ulcers increase the length of hospital stay, increase mortality, and shorten patients' lives and are recognised as an important challenge in the health system.[6-9] PU causes more than 60 000 deaths annually in the United States.[10] Data from a wide study showed that COVID-19 patients need more than three times as much care and attention to the occurrence of PU compared to other hospitalised patients.[11]

The rate of PU in patients admitted in hospitals in different countries varies from 3% to 53%. PU levels are higher in less developed and underdeveloped countries than in developed countries.[12-14] Germany, as an example, reported a prevalence of PU between 2% and 5% in various hospitals,[15] while in African countries it was reported up to 44%.[16] The average prevalence of PU in ICUs of Iranian hospitals was reported 19.57% (95% CI = 13.15, 25.97). In addition, this rate showed no significant changes from 2001 to 2019.[10] To date, no comprehensive study on PU in COVID-19 patients was conducted in Iran and the sample size of studies worldwide was very small.[17,18] However, the incidence of PU in Acute respiratory distress syndrome (ARDS) patients was 20.80% and 13.92% in the prone and supine positions, respectively.[19]In addition to the pain and suffering of the disease due to PU, the high prevalence of PU imposes huge costs on treatment system and patients and, further, it reduces the performance and efficiency of the workforce. The annual cost of PU in the United Kingdom after

adjustment for other causes was estimated at 531 million pound[20] and the annual cost of PU in the United States was estimated at 11 billion$.[21] In Iran, estimates showed that about 12 USD was spent on 1st-degree wounds and 66 834$ for 4th-degree wounds and, in general, 519 991 USD was spent on PU.[22] On the other hand, due to the imposition of very high costs following the corona pandemic in order to prevent and treat patients, the importance of PU prevention in this regard also seems absolutely necessary.

To the knowledge of researcher, no study was conducted to describe the incidence and prevalence of PU in COVID-19 patients admitted to ICUs in Iran. Due to the importance of the issue and the greater risk of PU in COVID-19 patients, this study was performed to evaluate the risk factors associated with the occurrence and prevalence of PU in COVID-19 patients in west of Iran.

2 | METHOD

2.1 | Study population and study design

It was an epidemiological cohort retrospective study of COVID-19 patients admitted to Imam Reza Hospital in Kermanshah province in west of Iran. Patients admitted to the corona ICUs were transferred from other hospitals in the city or surrounding cities to this hospital or were admitted to other wards of this hospital such as emergency units and then transferred to the corona ICUs. Considering that Imam Reza Hospital in Kermanshah province with a population of more than 1 million people, is the largest hospital centre for COVID-19 patients, and patients with different conditions are admitted to this hospital, so the results of the study could represent the reference population.

2.2 | Patient care and data collection

ICUs offer the same environmental and nursing conditions for COVID-19 patients. For example, all sections had the same anti-bedsore mattress and the same ventilation system. All patients received services such as changing position every 2 hours, dressing and wound irrigation according to the patient's condition and wound, physiotherapy to improve limb paralysis. The type and material of other medical devices such as Foley catheter, ventilator, and NIV were the same for all patients. One nurse was in charge to care for two patients per shift and using the same guideline to prevent PU. The data of this study were extracted from the hospital registry system with specific and high accuracy guidelines, which collected patients' information using questionnaires, medical records, and paraclinical samples in the laboratory. Samples of the present study included all COVID-19 patients who were hospitalised in the ICU due to COVID-19 from 20 April 2020 to 19 March 2021. Data related to this study were collected under the supervision of infectious disease specialist, wound care supervisor, and three wound care nurse from the patient registration system in the hospital.

2.3 | Inclusion and exclusion criteria

During the study period, 641 COVID-19 patients were admitted to ICUs. Of these, 81 were hospitalised in ICUs for less than 24 hours. One hundred and fifteen patients had an average Barden score of more than 14 at the time of admission and during hospitalisation, so they were excluded from the study. It should be noted that out of these 115 patients, 15 had 1st- and 2nd-degree PUs due to NIV mask in nose, 4 had 1st-degree ulcers in sacrum, which were not included in the study due to at least 14 Barden score. Thus, 445 men and women over the age of 20 years old admitted to COVID-19 ICUs were included in the study.

2.4 | Dependent variable

The response variable in this study was PU diagnosed by an infectious disease specialist and a wound care nurse. All patients who had PU at the time of admission or who developed PU during their stay in ICUs were included in the calculation of the prevalence, and all patients (whether or not they had ulcers during their stay in ICUs), who were tracked during the period of hospitalisation in ICU and were affected by PU, were included in the calculation. Every morning, trained nurses examined all parts of the patient's body to check for PU and record observations in the patient's registry system.

Wound site by sacrum, Coccyx, Buttock, Trochanter, Ischium, Sacroiliac, Occiput, nose, lips, ear, scapula, elbow, leg and knee, internal malleolus, extra malleolus, heel, and others (occiput, zygomatic and vertebrae of the finger and neck were marked. According to the latest stage of the wound, the degrees of the wound from grade one to four, necrosis, and deep-tissue injury (DTI) were investigated.

2.5 | Independent variables

Independent variables included age (20-39, 40-60, 61-80, and over 80 years), gender, BMI, which was calculated according to the formula for weight in kilograms divided by height squared (BMI less than 18.50 low weight, 18.50-24.99 normal, 25-29.99 overweight and BMI ≤30

were ranked in the obese group. The patient bed was equipped with a weighing system and the height measurement was as real as possible, and in case of limitation in the measurement, the nutrition consultant indirectly measured, and height estimation was recorded using measurement of ulna bone length. Underlying diseases were confirmed by the patient's specialist physician. Other factors examined were as follows: stool incontinence, comorbidity due to underlying diseases—having at least two chronic diseases at the same time—(including cardiovascular disease, diabetes, hypertension, cerebrovascular accident (CVA), end stage renal disease (ESRD), cerebral palsy (CP), pulmonary (COPD), cancer and others), diabetes (yes/no), PU caused by medical equipment (including respirators such as reservoir bag mask, NIV mask and ventilator), endotracheal tube and deep vein thrombosis (DVT), oedema (yes/no), paralysis of the limbs for any reason with no movement for at least a week (no/yes), haemoglobin concentration (5-10, 10-15 and more than 15 g/dL), body temperature using a digital thermometer in all patients (36.5-37.2°C, 37.3-38.2°C and above 38.2°C), using vasopressor medicine, LOS (1-5, 6-10 and more than 10 days), Glasgow Coma Scale (GCS) (severe decrease in level of consciousness 3-8, medium level of consciousness 9-12 and mild level pf consciousness 13-15)[23] and Barden score.

2.6 | PU risk scale

Braden scale is a standard tool for predicting the risk of PU. Braden score for each person was calculated based the sum of scores obtained from the variables of sensory perception, moisture, activity, mobility, nutrition, friction and shear. Each of these factors was rated from 1 (worst case) to 3 or 4 (best condition) according to the patient's condition; therefore, the minimum score could be 6 and the maximum 23.[24] A score above 18 indicated a risk-free status for PU, 18-15 mild risk, 12-14 moderate risk, 9-12 high risk, and less than 9 indicated a severe risk. The degree of agreement to determine the Braden score between the interviewers with kappa coefficient was evaluated and approved with an agreement between 0.67 and 0.88. For wounds at the time of admission to ICUs, the Braden score at the first day of hospitalisation, and for new PUs in ICUs, the average degree of Barden score was used, which was measured every 72 hours in patients.

2.7 | Statistical methods

Variables were described using the number (percentage), mean (SD), median (deviation inter quarters) and Chi-square was used for significance between the grouped variables.

In the present study, since the entry and exit of patients did not occur at a specific time, the cohort was dynamic and did not provide a specific time interval and the incidence rate was calculated as time to event: all patients were monitored from the first day of hospitalisation in COVID-19 ICU until the last day of hospitalisation and the first PU was considered the first endpoint and in case of recurrence PU as the second endpoint, and so on until the last ulcer. Due to the multiplicity of ulcers in some patients, incidence density was used to calculate the incidence and the denominator of the fraction was the total people-day during the follow-up period. Other assumptions about the use of density incidence, such as the uniformity of risk, were based on the inclusion criteria described in the follow-up time in this study.

In the univariate regression model, cox regression was used to estimate the hazard ratio in order to investigate the relationship between independent variables and the incidence rate of PUs. The Kaplan-Meier diagram compared the cumulative incidence of PU in two groups of patients with a Braden score ≤9 with a Braden score greater than 9. Odds ratio (OR) was used to show the relationship between PU prevalence rate and each of the independent variables. The OR was the fraction of odds of a consequence occurring to the odds of a non-occurrence. For statistical significance, P-value < .05 was considered, and therefore, 95% confidence interval was determined. All data were analysed using Stata statistical software version 15 and Excel 2016 software using appropriate statistical tests.

2.8 | Ethical considerations

Ethics Committee of Kermanshah University of Medical Sciences (KUMS) approved the study with the code IR.KUMS.REC.1397.712. The objectives of the study were stated for all samples and the confidentiality of their information and answers were emphasised and a written and informed consent was obtained from all participants. In case the patient was in bad health situation, patient's companion was required to give informed consent to enter the study and the objectives of the study were explained.

3 | RESULT

3.1 | Descriptive

Four hundred and forty-five patients admitted to the COVID-19 ICUs were analysed. One hundred and eighty-three (41.12%) patients were male. The mean age of patients was 63 (SD = 78.9) years. Three hundred and

TABLE 1 Total number of PUs, broken down into common areas based on independent ulcer-related variables

	Total 445	PU 355 (79.78)	Sacrum 234 (52.58)	Nose 156 (35.06)	buttocks 152 (34.16)	Ankle 57 (12.81)	Scapula 55 (12.36)	Trochanter 54 (12.13)	Heel 47 (10.56)	Lips 45 (10.11)	Sacroiliac 45 (10.11)	Other 115 (25.84)
Sex												
Male	183 (41.12)	145 (79.23)	92 (50.27)	66 (36.06)	75 (40.98)	21 (11.48)	19 (10.38)	18 (9.84)	17 (9.29)	16 (8.74)	17 (9.29)	37 (20.22)
Female	262 (58.88)	210 (80.15)	142 (54.20)	90 (34.35)	77 (29.39)	36 (13.74)	36 (13.74)	36 (13.74)	30 (11.45)	29 (11.07)	28 (10.69)	78 (29.77)
P-value		.813	.115	.056	.011	.482	.290	.215	.466	.42	.630	.024
Age (y)												
20-40	48 (10.79)	33 (68.75)	20 (41.67)	12 (24.99)	12 (25.0)	7 (14.58)	1 (2.08)	3 (6.25)	2 (4.17)	4 (8.33)	8 (16.67)	8 (16.67)
40-59	112 (25.17)	85 (75.89)	44 (39.29)	30 (26.79)	32 (28.57)	14 (12.50)	15 (13.39)	7 (6.25)	15 (13.39)	10 (8.92)	12 (10.71)	33 (29.46)
60-79	210 (47.19)	169 (80.48)	119 (56.67)	60 (28.56)	76 (36.19)	22 (10.48)	26 (12.38)	32 (15.24)	17 (8.10)	22 (10.48)	16 (7.62)	52 (24.76)
≤80	75 (16.85)	68 (90.67)	51 (68.0)	51 (68.01)	32 (42.67)	14 (18.67)	13 (17.33)	12 (16.0)	13 (17.33)	9 (12.0)	9 (12.0)	22 (29.33)
P-value		.017	<.001	.043	.105	.324	.090	.043	.046	.024	.257	.323
BMI (kg/m^2)												
<18.5	22 (4.94)	12 (54.55)	10 (45.45)	6 (27.27)	4 (18.18)	3 (13.64)	2 (9.09)	0	2 (9.09)	2 (9.09)	2 (9.09)	5 (22.73)
18.5-24.9	154 (34.61)	120 (77.92)	81 (52.60)	42 (27.27)	51 (33.12)	18 (11.69)	24 (15.58)	19 (12.34)	8 (5.19)	16 (10.39)	15 (9.74)	38 (24.68)
25-19.9	206 (46.29)	169 (82.04)	113 (54.85)	72 (34.95)	72 (34.95)	27 (13.11)	17 (8.25)	28 (13.59)	29 (14.08)	21 (10.19)	20 (9.71)	52 (25.24)
≥30	63 (14.16)	54 (85.71)	30 (47.62)	36 (57.15)	25 (39.68)	9 (14.29)	12 (19.05)	7 (11.11)	8 (12.70)	6 (9.52)	8 (12.70)	20 (31.75)
P-value		.012	.683	.046	.071	.955	.057	.319	.052	.996	.908	.704
Comorbidity												
No	264 (59.33)	196 (74.24)	126 (47.73)	87 (32.94)	86 (32.58)	33 (12.50)	28 (10.61)	32 (12.12)	27 (10.23)	25 (9.47)	29 (10.98)	64 (24.24)
Yes	181 (40.67)	159 (87.85)	108 (59.67)	69 (38.13)	66 (36.46)	24 (13.26)	27 (14.92)	22 (12.13)	20 (11.05)	20 (11.05)	16 (8.84)	51 (28.18)
P-value		<.001	.013	.578	.396	.814	.175	.992	.782	.587	.461	.352
Diabetes												
No	317 (71.24)	241 (76.03)	264 (52.74)	87 (27.45)	96 (30.28)	41 (12.93)	32 (10.09)	38 (11.99)	38 (11.99)	29 (9.15)	26 (8.20)	73 (23.03)
Yes	128 (28.76)	114 (89.06)	70 (54.69)	69 (53.91)	56 (43.75)	16 (12.50)	23 (17.97)	16 (12.50)	9 (7.03)	16 (12.50)	19 (14.84)	42 (32.81)
P-value		.002	.572	.009	.007	.901	.022	.881	.124	.288	.049	.033
Stool incontinence												
No	124 (27.64)	87 (70.73)	53 (43.09)	39 (31.71)	25 (30.49)	12 (9.76)	9 (7.32)	10 (8.13)	7 (5.69)	8 (6.50)	11 (8.94)	26 (21.14)
Yes	321 (72.11)	267 (83.18)	180 (56.07)	117 (36.45)	127 (35.18)	45 (13.98)	46 (14.29)	44 (13.66)	40 (12.42)	37 (11.53)	34 (10.56)	89 (27.64)
P-value		.003	.013	.760	.044	.234	.046	.110	.039	.119	.613	.161
Movement paralysis												
No	400 (89.89)	319 (79.75)	208 (52.0)	147 (36.75)	135 (33.75)	51 (12.75)	51 (12.75)	45 (11.25)	41 (10.25)	44 (11.0)	41 (10.25)	107 (26.75)

(Continues)

TABLE 1 (Continued)

	Total 445	PU 355 (79.78)	Sacrum 234 (52.58)	Nose 156 (35.06)	buttocks 152 (34.16)	Ankle 57 (12.81)	Scapula 55 (12.36)	Trochanter 54 (12.13)	Heel 47 (10.56)	Lips 45 (10.11)	Sacroiliac 45 (10.11)	Other 115 (25.84)
Yes	45 (10.11)	36 (80)	26 (57.78)	9 (20.01)	17 (37.78)	6 (13.33)	4 (8.89)	9 (20.0)	6 (13.33)	1 (2.22)	4 (8.89)	8 (17.78)
P-value		.968	.462	.065	.589	.912	.456	.088	.523	.064	.774	.192
Oedema												
No	322 (72.36)	254 (78.88)	164 (50.93)	114 (35.40)	100 (31.06)	39 (12.11)	35 (10.87)	40 (12.42)	33 (10.25)	31 (9.63)	33 (10.25)	82 (25.47)
Yes	123 (27.64)	101 (82.11)	70 (56.91)	42 (34.14)	52 (42.28)	18 (14.63)	20 (16.26)	14 (11.38)	14 (11.38)	14 (11.38)	12 (9.76)	33 (26.83)
P-value		.448	.259	.611	.026	.476	.122	.764	.728	.583	.878	.769
LOS												
1-5	115 (25.84)	80 (69.56)	56 (48.70)	27 (23.49)	30 (26.09)	10 (8.70)	9 (7.83)	14 (12.17)	8 (6.96)	5 (4.35)	12 (10.43)	22 (19.13)
5-10	140 (31.46)	110 (78.57)	72 (51.43)	33 (23.58)	44 (31.43)	23 (16.43)	14 (10.0)	22 (15.71)	17 (12.14)	10 (7.14)	16 (11.43)	32 (22.86)
>10	190 (42.70)	165 (86.84)	106 (55.79)	96 (56.52)	78 (41.05)	24 (12.63)	32 (16.84)	18 (9.47)	22 (11.56)	30 (15.79)	17 (8.95)	61 (32.11)
P-value		.002	.459	.011	.033	.184	.040	.229	.339	.002	.754	.027
Braden scale												
13-14	154 (34.61)	116 (75.32)	76 (49.35)	38 (24.67)	43 (27.92)	15 (9.74)	15 (9.74)	17 (11.04)	13 (8.44)	10 (6.49)	13 (8.44)	34 (22.08)
10-12	183 (41.12)	147 (80.33)	94 (51.37)	56 (37.02)	65 (35.52)	24 (13.11)	20 (10.93)	21 (11.48)	18 (9.84)	21 (10.88)	16 (8.74)	48 (26.23)
6-9	108 (24.27)	92 (85.19)	64 (59.26)	62 (57.41)	44 (40.74)	18 (16.67)	20 (18.52)	16 (14.81)	16 (14.81)	14 (12.96)	16 (14.81)	33 (30.56)
P-value		.006	.043	.001	.525	.431	.039	.798	.234	.041	.208	.155

Note: Other include (occipital, ear, ischium, coccyx, elbow, lumbar vertebrae, leg, knee, finger, neck).

TABLE 2 Prevalence of PU and crude OR in patients admitted to COVID-19 ICUs (some patients had more than one ulcer at different degrees)

	Degree1		Degree2		Degree3		Necrosis		DTI	
Independent variables	**Total 252 (55.38)**	**Odd ratio (95% CI)**	**Total 188 (41.32)**	**Odd ratio (95% CI)**	**Total 34 (7.47)**	**Odd ratio (95% CI)**	**Total 28 (6.15)**	**Odd ratio (95% CI)**	**Total 27 (5.93)**	**Odd ratio (95% CI)**
Sex										
Male	95 (51.91)	1	83 (45.36)	1	12 (6.56)	1	8 (4.37)	1	14 (7.65)	1
Female	157 (59.92)	1.56 (0.98, 2.48)	105 (40.08)	0.75 (0.49, 1.14)	22 (8.40)	1.37 (0.81, 2.31)	20 (7.63)	1.80 (0.77, 4.21)	13 (4.96)	0.62 (0.26, 1.36)
Age										
20-40	22 (45.83)	1	21 (43.75)	1	5 (10.42)	1	2 (4.17)	1	1 (2.08)	1
40-59	55 (45.11)	0.92 (0.39, 1.54)	46 (41.07)	0.67 (0.29, 1.54)	9 (8.04)	1.30 (0.49, 3.41)	7 (6.25)	1.39 (0.27, 7.07)	8 (7.14)	3.32 (0.40, 27.68)
60-79	126 (60.0)	1.47 (0.66, 3.27)	83 (39.52)	0.55 (0.26, 1.19)	13 (6.19)	0.97 (0.39, 2.42)	15 (7.14)	1.51 (0.33, 6.94)	14 (6.67)	2.89 (0.37, 22.77)
≤80	49 (65.33)	1.29 (0.53, 3.16)	38 (50.67)	0.72 (0.31, 1.70)	7 (9.33)	0.88 (0.31, 2.46)	4 (5.33)	0.97 (0.17, 5.58)	4 (5.33)	2.0 (0.21, 18.64)
BMI (kg/m^2)										
<18.5	10 (45.45)	1	5 (22.73)	1	2 (2.09)	1	0	1	1 (4.55)	1
18.5-24.9	85 (55.19)	0.49 (0.10, 2.33)	62 (40.26)	1.50 (0.45, 4.98)	7 (4.55)	0.31 (0.06, 1.69)	13 (8.44)	1.19 (0.40, 3.53)	8 (5.19)	0.79 (0.09, 6.88)
25-29.9	126 (61.17)	0.59 (0.12, 2.78)	92 (44.66)	1.67 (0.51, 5.48)	20 (9.71)	0.67 (0.14, 3.29)	10 (4.85)	0.62 (0.20, 1.89)	10 (4.85)	0.69 (0.08, 5.91)
≥30	31 (49.21)	0.27 (0.05, 1.35)	29 (46.03)	1.62 (0.46, 5.76)	5 (7.94)	0.51 (0.09, 3.01)	5 (7.94)	1.0	8 (12.70)	1.91 (0.22, 16.93)
Comorbidity										
No	145 (54.92)	1	103 (39.02)	1	18 (6.82)	1	11 (4.17)	1	14 (5.30)	1
Yes	107 (59.12)	0.64 (0.40, 1.02)	85 (46.96)	1.16 (0.76, 1.78)	16 (8.84)	1.19 (0.71, 1.98)	17 (9.39)	1.75 (0.81, 3.70)	13 (7.18)	1 (0.45, 2.21)
Diabetes										
No	171 (53.94)	1	122 (38.49)	1	23 (7.26)	1	20 (6.31)	1	18 (5.68)	1
Yes	81 (63.28)s	1.0 (0.61, 1.64)	66 (51.56)	1.34 (0.86, 2.10)	11 (8.59)	1.01 (0.48, 2.16)	8 (6.25)	0.83 (0.36, 1.96)	9 (7.03)	1.06 (0.46, 2.44)
Stool incontinence										
No	60 (48.78)	1	44 (35.77)	1	7 (5.69)	1	3 (3.44)	1	4 (3.25)	1
Yes	192 (59.63)	1.17 (0.70, 1.95)	144 (44.72)	1.19 (0.74, 1.89)	27 (8.39)	1.78 (0.96, 3.29)	25 (7.76)	2.88 (0.85, 9.79)	23 (7.14)	1.95 (0.65, 5.80)
Movement paralysis										
No	228 (57.0)	1	170 (42.50)	1	28 (7.0)	1	23 (5.75)	1	25 (6.25)	1
Yes	24 (53.33)	0.80 (0.38, 1.66)	18 (40.0)	0.88 (0.44, 1.75)	6 (13.33)	2.08 (0.80, 5.42)	5 (11.11)	2.08 (0.74, 5.85)	2 (4.44)	0.69 (0.16, 3.05)
Vasopressor drugs										
No	192 (54.08)	1	152 (42.82)	1	26 (7.32)	1	22 (6.20)	1	20 (5.63)	1
Yes	60 (66.67)	2.16 (1.13, 4.14)	36 (40.0)	0.83 (0.50, 1.39)	8 (8.89)	1.21 (0.52, 2.80)	6 (6.67)	1.06 (0.41, 2.71)	7 (7.78)	1.39 (0.56, 3.42)

(Continues)

TABLE 2 (Continued)

Independent variables	Degree1		Degree2		Degree3		Necrosis		DTI	
	Total 252 (55.38)	Odd ratio (95% CI)	Total 188 (41.32)	Odd ratio (95% CI)	Total 34 (7.47)	Odd ratio (95% CI)	Total 28 (6.15)	Odd ratio (95% CI)	Total 27 (5.93)	Odd ratio (95% CI)
Haemoglobin (gr/dL)										
<10	95 (56.21)	1	89 (52.66)	1	19 (11.24)	1	16 (9.47)	1	12 (7.10)	1
10-15	145 (57.77)	1.32 (0.82, 2.13)	89 (35.46)	0.47 (0.30, 0.73)	12 (4.78)	0.41 (0.19, 0.88)	11 (4.38)	0.46 (0.21, 1.02)	14 (5.58)	0.81 (0.36, 1.82)
>15	12 (48.0)	0.69 (0.27, 1.82)	10 (40.0)	0.56 (0.22, 1.44)	3 (12.0)	1.11 (0.30, 4.18)	1 (4.0)	0.40 (0.05, 3.23)	1 (4.0)	0.56 (0.07, 4.53)
36.5-37.2	139 (57.20)	1	96 (39.51)	1	17 (7.0)	1	14 (5.76)	1	12 (4.94)	1
Temperature °C										
37.3-38.2	75 (51.37)	0.75 (0.46, 1.24)	66 (45.21)	1.40 (0.88, 2.24)	11 (7.53)	1.11 (0.50, 2.46)	13 (8.90)	1.65 (0.75, 3.66)	10 (6.85)	1.46 (0.61, 3.49)
>38.3	38 (67.86)	1.21 (0.59, 2.49)	26 (46.43)	1.08 (0.58, 2.02)	6 (10.71)	1.40 (0.52, 3.77)	1 (1.79)	0.26 (0.03, 2.02)	5 (8.93)	1.67 (0.56, 4.97)
Oedema										
No	179 (55.59)	1	128 (39.75)	1	25 (7.76)	1	19 (5.90)	1	16 (4.97)	1
Yes	73 (59.35)	1.09 (0.65, 1.82)	60 (48.78)	1.44 (0.90, 2.30)	9 (7.32)	0.90 (0.40, 1.99)	9 (7.32)	1.21 (0.53, 2.77)	11 (8.94)	1.82 (0.81, 4.07)
LOS (d)										
1-5	59 (51.30)	1	44 (38.26)	1	11 (9.57)	1	2 (1.74)	1	6 (5.22)	1
5-10	78 (55.71)	1.52 (0.82, 2.81)	48 (34.29)	0.92 (0.52, 1.62)	8 (5.71)	0.59 (0.23, 1.54)	10 (7.14)	4.63 (1.01, 21.73)	7 (5.0)	1.0 (0.32, 3.09)
>10	115 (60.53)	1.34 (0.77, 2.34)	96 (50.53)	1.64 (0.97, 2.76)	15 (7.89)	0.74 (0.33, 1.70)	16 (8.42)	4.89 (1.10, 21.77)	14 (7.37)	1.34 (0.50, 3.62)
Braden scale										
13-14	91 (59.09)	1	53 (34.42)	1	6 (3.90)	1	4 (2.60)	1	5 (3.25)	1
10-12	102 (55.74)	0.62 (0.35, 1.10)	77 (42.08)	1.39 (0.85, 2.27)	18 (9.84)	2.36 (1.21, 4.63)	9 (4.92)	1.83 (0.55, 6.09)	11 (6.01)	1.80 (0.61, 5.32)
6-9	59 (54.63)	0.49 (0.27, 0.91)	58 (53.70)	2.10 (1.20, 3.67)	10 (9.26)	3.03 (1.48, 6.20)	15 (13.89)	5.45 (1.74, 17.06)	11 (10.19)	3.01 (1.01, 9.01)

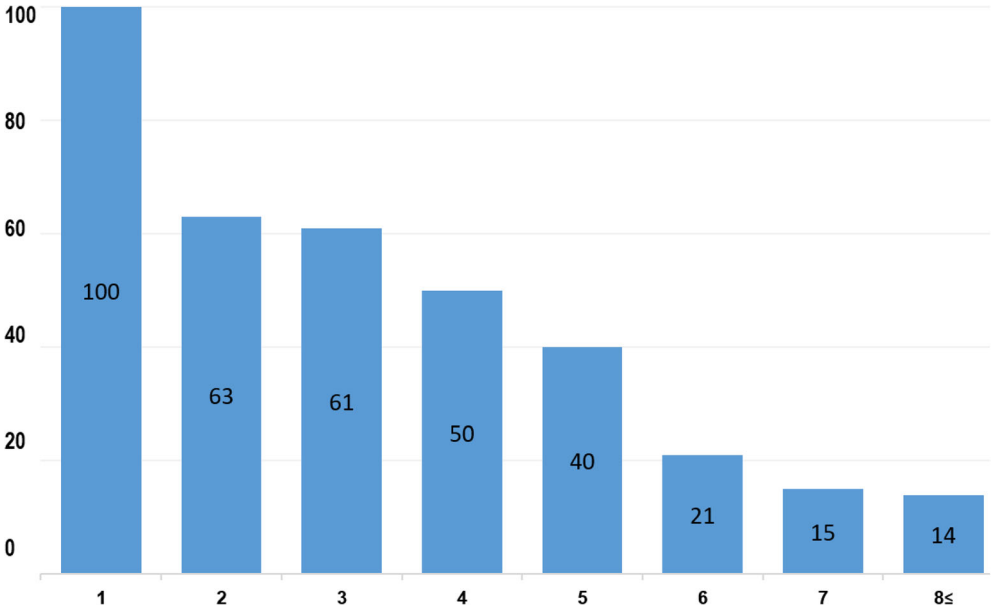

FIGURE 1 Maximum total PU in patients admitted to COVID-19 ICUs (the last column included cases of 8 or more ulcers were collected)

sixty-two (81.12) participants had at least one underlying disease, of which 128 had diabetes, 88 high blood pressure, 48 heart disease, CVA or ESRD, and 98 had other underlying diseases. Of these, 181 (40.67%) had comorbidity. Three hundred and twenty-one (72.11%) patients had stool incontinence, 45 (10.11%) patients had movement paralysis (Table 1).

3.2 | Prevalence cases

Results reported in this part are shown in Tables 1 and 2.

One hundred and eight (24.27%) patients with a Braden score of 6-9 had a very high risk of developing PU, of which 58.33% were female. Two hundred and sixty-five patients had PU at the time of admission, of which 118 recurred ulcers in ICUs and 90 other patients without ulcers had PU for the first time during their stay in ICUs. Therefore, in general, the prevalence of PU for all cases of ulcers was (445/355) 79.78% and 49.66% without first-degree ulcers.

Among the diagnosed PU cases, (355/255) 71.83% of patients had more than one ulcer. The maximum number of PUs diagnosed in patients was only one ulcer per 100 patients and 2 ulcers for 63 patients and the highest number of PUs was recorded for one patient with 11 ulcers (Figure 1). A total of 1152 cases of PU occurred, of which 717 were in patients admitted to ICUs (first day of follow-up) and 435 were developed during follow-up. In total, the highest number of PU with 234 wounds (in 234 patients) was seen in the sacrum, followed by buttocks with 199 ulcers in 152 patients. One hundred and fifty-six patients also developed nasal ulcers (Figure 2).

With the increase in age, the number of PUs observed increased significantly ($P = .017$), so the prevalence of PU in patients over 80 years was 90.67%. The prevalence of PU ($P = .006$) increased with decreasing Braden score. Age, Length of stay (LOS), and Braden score showed a significant relationship with the prevalence of PU in the nose and lips, and diabetes and BMI only for the nose (Table 1).

First-degree ulcer was the most common ulcer with 651 cases in 252 (55.38%) patients. Among all the studied variables, the highest prevalence of grade 1 PU was in patients taking vasopressor with 66.67%, which had a 2.16 (1.13, 4.14) times higher odds of PU compared to other patients (Table 2). Patients with haemoglobin level 10-15 had a lower odds of developing two or more degrees PU, which according to the results of the OR in Table 2, this association was significant for second- and third-degree ulcers. There was no significant relationship between PU degrees for age and sex.

Compared to patients with Braden score of 13-14, those with a Braden score of 6-9 for grade 1 ulcers were OR = 0.49 (95% CI = 0.27, 0.91) times affected with PU; however, they had a significantly higher odds of developing PU for grades 2 to 4.

3.3 | Incidence cases

The results presented below are based on Table 3. The median number of days hospitalised in the COVID-19 ICUs until the onset of ulcers was 8 (IQR = 5-11) days. The mean number of hospitalisation days in incidence cases was 16.4 (SD = ±8.85) days and 9.23 (SD = ±9.43) days for patients with no UP.

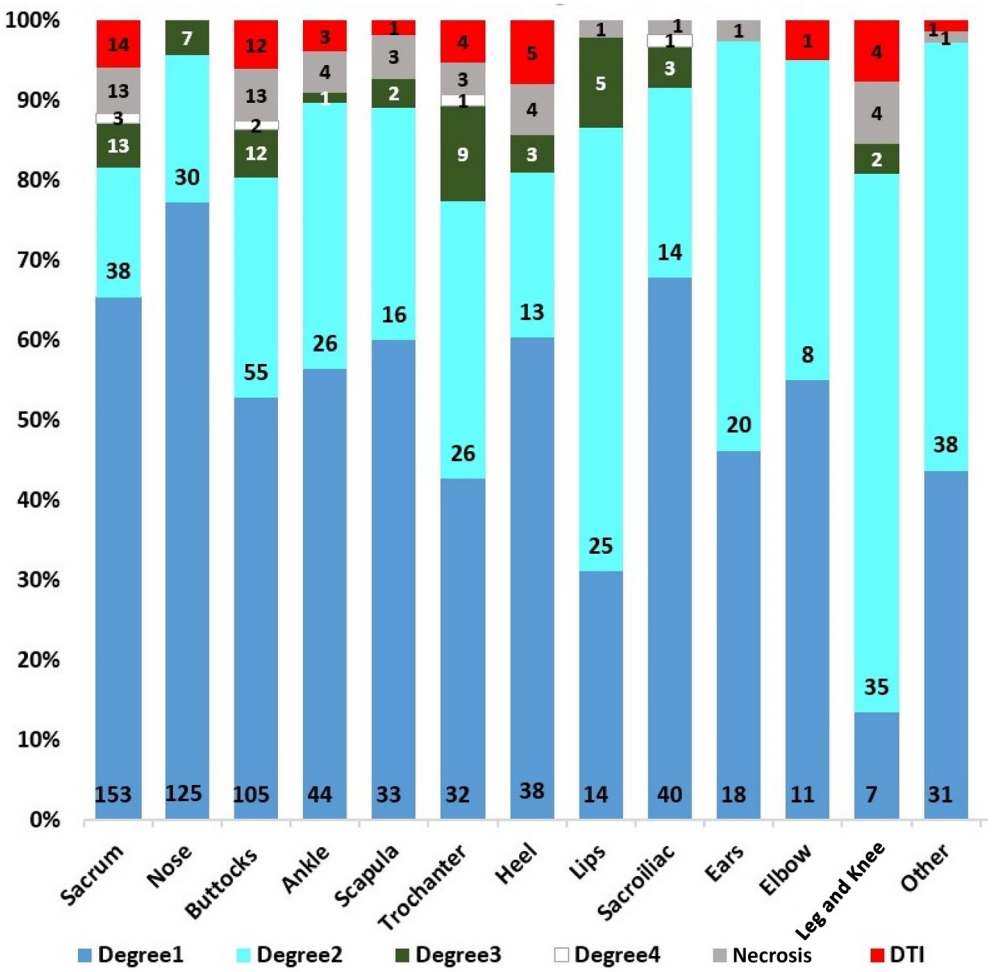

FIGURE 2 Total number of lesions diagnosed and their degrees relative to PU site in patients admitted to COVID-19 ICUs

Ulcer incidence ratio was 46.74% (208/445) among 445 patients followed. One hundred and one patients had only first-degree ulcers, and if they are not considered, the incidence ratio for second and more degree ulcers was 24.04% (107/445). A total of 1775 patient-days were obtained during the hospital stay for all patients until the onset of PU. Similarly, considering 208 patients affected in ICUs as incidence, incidence density (*100 patient-days) was calculated to be 11.71% (9.66_13.74).

A total of 435 wounds with varying degrees of incidence occurred in 208 patients in ICUs, so some patients developed ulcers of varying degrees that included patients in more than one column (depending on the degree of ulcer) in the incidence calculation.

Medical device related pressure ulcers: among the participants, 71 patients underwent oxygen therapy with oxygen masks with reservoir bag (OMR) that two of them developed first-degree PU on the nose. Twenty patients with OMR were hospitalised and got NIV later. Two hundred and ninety-five patients were admitted with NIV status upon admission to the ward. Among 315 patients under NIV, 123 patients developed first-degree ulcer, 25 patients developed second-degree ulcer, 7 patients developed third-degree ulcer on the nose, and also 21 patients developed first-degree ulcer on the cheek. Seventy-nine patients at the admission and 143 patients receiving NIV underwent tracheal intubation. Out of 222 intubation patients, 11 patients developed first-degree ulcer, 25 patients developed second-degree ulcer, 5 patients developed third-degree ulcer and one patients developed necrotic lip ulcer. Patients who underwent NIV had a 3.42 (1.78, 4.98) times higher risk of developing PU compared to patients who underwent intubation. A nasogastric tube (NG tube) was fixed in 263 patients, of which 5 patients developed second-degree nasal ulcers due to NGT. Nineteen patients also had anti-Embolism stocking socks, of which 4 patients were injured due to embolism prevention socks (3 patients with grade 1 ulcer, 1 patients with grade 2 ulcer).

Incidence density for PU was similar for men and women. Patients with GCS 3-8 were significantly 1.44 times more likely to develop PU than patients with GCS 13-15. 44.44% of patients with movement paralysis in ICUs developed PU, but according to cox regression results, no significant difference was observed with patients who did not have movement paralysis. Incidence

TABLE 3 Incidence rate (density) and hazard ratio and incidence ratio rated based on PU incidence rates in patients admitted to COVID-19 ICUs during the follow-up period

	Incidence cases 208 (46.74)	**Incidence rate (×100 people-day)**	**Degree1 161 (36.18)**	**Degree2 71 (15.96)**	**Degree3 14 (3.08)**	**Hazard ratio (95% CI)**
Sex						
Male	81 (44.26)	11.60	65 (35.52)	30 (16.39)	6 (3.28)	1
Female	127 (48.47)	11.77	96 (36.64)	41 (15.65)	8 (3.06)	1.04 (0.75, 1.45)
Age						
20-40	20 (41.67)	10.37	15 (31.25)	13 (27.08)	2 (4.16)	1
40-59	51 (45.54)	10.92	40 (35.71)	19 (16.96)	2 (1.18)	1.05 (0.59, 1.86)
60-79	100 (47.62)	12.35	77 (36.67)	29 (13.81)	7 (3.33)	1.34 (0.79, 2.30)
≥80	37 (49.33)	14.36	29 (38.67)	10 (13.33)	3 (4.0)	1.39 (0.73, 2.64)
BMI (kg/m^2)						
18.5	8 (36.36)	13.33	6 (27.27)	1 (4.55)	1 (4.54)	1
35	70 (45.45)	11.44	55 (35.71)	23 (14.)	5 (3.25)	0.65 (0.23, 1.83)
30	103 (50.0)	12.22	76 (36.89)	33 (16.02)	4 (1.94)	0.75 (0.27, 1.83)
>30	27 (42.86)	10.45	24 (38.09)	14 (22.22)	4 (6.45)	0.58 (0.20, 1.71)
Diabetes						
No	130 (41.01)	11.44	98 (30.91)	37 (11.67)	6 (1.90)	1
Yes	88 (60.94)	12.01	63 (49.22)	34 (26.56)	8 (6.25)	1.12 (0.81, 1.55)
Stool incontinence						
No	54 (43.55)	10.65	40 (32.25)	18 (14.63)	3 (2.42)	1
Yes	154 (47.97)	12.08	121 (37.69)	53 (16.46)	11 (3.43)	1.27 (0.87, 1.81)
Movement paralysis						
No	188 (47.0)	11.74	150 (37.5)	59 (14.75)	12 (3.0)	1
Yes	20 (44.44)	11.01	11 (24.44)	12 (26.67)	2 (4.44)	1.15 (0.80, 1.65)
Vasopressor drugs						
No	169 (47.61)	11.72	127 (35.77)	58 (16.34)	11 (3.10)	1
Yes	39 (43.33)	11.60	34 (37.78)	13 (14.44)	3 (3.33)	0.94 (0.62, 1.43)
Haemoglobin (gr/dL)						
<10	77 (45.56)	12.25	56 (33.14)	32 (18.93)	5 (2.96)	1
10-15	120 (47.81)	11.47	97 (38.64)	35 (13.94)	8 (3.19)	0.88 (0.62, 1.24)
>15	11 (44.0)	10.53	8 (32.0)	4 (16.0)	1 (4.0)	0.79 (0.37, 1.66)
Temperature °C						
36.5-37.2	112 (46.09)	11.30	88 (36.21)	36 (14.81)	6 (2.46)	1
37.3-38.2	69 (47.26)	12.86	52 (35.62)	26 (17.81)	6 (4.10)	1.26 (0.88, 1.81)
>38.3	27 (48.21)	10.81	21 (37.50)	9 (16.07)	2 (3.58)	0.86 (0.51, 1.44)
Oedema						
No	144 (44.72)	11.70	110 (34.16)	47 (14.60)	10 (3.10)	1
Yes	64 (52.03)	11.71	51 (41.46)	24 (19.51)	4 (3.26)	1.14 (0.83, 1.52)
Equipment						
Int	42 (18.92)	11.85	11 (26.19)	25 (11.26)	5 (11.90)	1
NIV	176 (55.87)	12.44	144 (45.71)	25 (7.93)	7 (3.98)	3.42 (1.78, 4.98)
Other	11 (3.12)	10.32	5	6	0	0.65 (0.34, 1.89)
GCS						
13-15	84 (38.01)	10.25	62 (28.05)	19 (13.48)	4 (1.81)	1

(Continues)

TABLE 3 (Continued)

	Incidence cases 208 (46.74)	Incidence rate (×100 people-day)	Degree1 161 (36.18)	Degree2 71 (15.96)	Degree3 14 (3.08)	Hazard ratio (95% CI)
9-12	33 (39.76)	11.80	25 (30.12)	7 (8.43)	1 (1.20)	1.38 (0.80, 2.39)
3-8	91 (64.54)	12.64	74 (52.48)	45 (20.36)	9 (6.38)	1.44 (1.01, 2.09)
Braden scale						
13-14	53 (68.24)	9.28	48 (31.17)	21 (13.64)	1 (0.65)	1
10-12	47 (56.63)	11.89	37 (20.22)	32 (17.49)	4 (2.19)	1.14 (0.78, 1.66)
6-9	32 (66.67)	17.82	26 (24.07)	18 (16.67)	2 (1.85)	2.72 (1.76, 4.21)

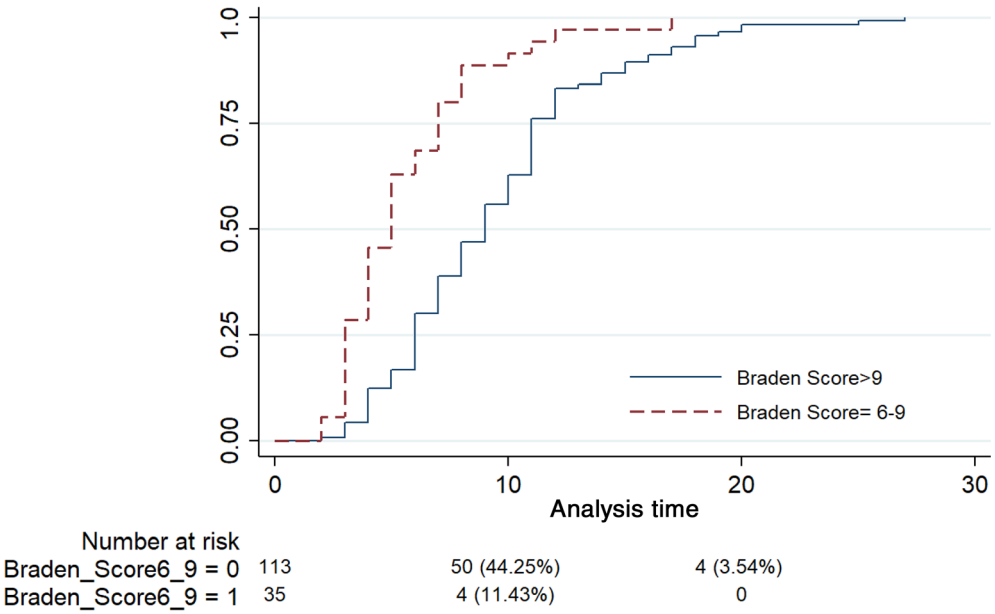

FIGURE 3 Kapeyer diagram proportion

density decreased with an increase in haemoglobin concentration and BMI; however, the results of hazard ratio were not statistically significant.

Finally, 321 (72.13%) patients died in ICUs and 124 (27.86%) patients were discharged from ICUs after recovery and transferred to other wards of the hospital. Mean age of dead patients was obtained 67.44 (SD = ±13.14) with mean number of hospitalisation days 12.34 (SD = ±13.14); mean age of other patients was 59.8 (SD = ±13.35) with mean number of hospitalisation days 14.23 (SD = ±15.32). There was no significant difference between the number of ulcers in patients regarding death or discharge ($P = .784$).

The incidence of PU increased significantly with decrease in Braden score, so the hazard ratio in relation to Braden score of 6-9 indicated that this group was 2.72 (1.76, 4.22) times more likely to develop PU than patients with Braden score 13-14 (Table 3). Figure 3 shows the Kaplan Meyer diagram of the risk of cumulative PU. The cumulative incidence (risk) of ulceration up to the tenth day after ICU admission in patients with 6-9 Barden score was 88.57%, compared with 55.75% for patients with a Barden score higher than 9 at the same time. It was found that it represented a significant risk for patients with Braden 6-9 for faster occurrence of PU.

4 | DISCUSSION

The present study investigated the incidence and prevalence of PU and the factors affecting it in COVID-19 patients with Braden score less than 14 admitted to ICUs. In general, the incidence ratio of PU in the patients under study was 46.74% and the prevalence was about 80%. In addition, excluding patients with only first-degree ulcers, the incidence and prevalence were 24% and 49.66%, respectively. The prevalence of first-degree ulcers in our study was highest with 56.5%, and for the worst ulcers, 7 patients had fourth-degree ulcers, 28 had unstageable ulcers, and 27 had DTI. A meta-analysis of 39 systematic reviews of more than 2 500 000 patients with PU showed that the pooled prevalence in hospitalised patients was 43.5% for first-degree ulcers and

28% for second-degree ulcers.[25] However, a study on patients admitted to 25 hospitals in China reported second-degree ulcers as the most common ulcer in 44.3% of patients.[26] The incidence and prevalence in different studies are very variable for various reasons and the prevalence of PU was reported from 4.94% to 54%.[27-31] In this regard, since only patients with Braden score under 14 were included in the present study, this difference could be explained. Therefore, the higher rate of incidence and prevalence was expected. In addition, patients admitted to the ICUs, especially COVID-19 patients, were at higher risk for PU than other wards due to the critical conditions and the wide range of complications, especially the need to use invasive and non-invasive methods for oxygen delivery.[2,32-34]

In a study on PU in COVID-19 patients in the UK, 75.8% of patients had PU. But the prevalence of PU in patients with prone position was 88.7% that 88.3% of all ulcers were on the anterior surface. The most common site of ulceration was oral with 34.6%.[35] In another study conducted in Spain, the most common site of PU was face with 69%, and in general, second-degree PU had the highest number of ulcers compared to other degrees.[36] But in our study, the incidence of ulcers, especially in the oral area, was lower, so that 45 (10.11%) patients developed lip ulcers due to the use of ventilators. In justification of this finding, it can be said that the two studies mentioned were performed on COVID-19 patients who had a prone position, while in the present study, due to some conditions and patients' intolerance, patients were placed on the prone position for a very short time. This could lead to a significant increase in PU on the face and especially the lips.[37] In fact, the use of prone position increased the susceptibility to PU even more than three times, especially in the face.[38-41] But in the present study, the risk of PU in patients under NIV was 3.42 times higher than patients who were intubated, so 55.87% of patients under NIV grew PUs. The bridge of the nose was the most common wound site in body due to the use of medical equipment, so out of 315 patients under NIV, 155 patients had PUs on their noses. Fujimoto et al showed that the highest incidence of ulcers was due to the NIV mask on the bridge of the nose.[42] In fact, long-term use of NIV mask with pressure increased the risk of PU in patients.[43] Other studies on evaluating PU with COVID-19 could not be compared to the present study for some reason, including case series studies or case reports or the care staff of COVID-19 ICUs.

The highest incidence of PU was reported for Braden score of 6-9 with 66.67%. The incidence of PU increased with the decrease in Braden score. Patients with Braden score of 6-9 had a 2.72 (1.76, 4.21) times risk of PU compared to patients with Braden score of 13-14. This relationship was also reported in previous research.[44-46] In a study conducted in Iran, patients with severe Braden score (less than 12) and moderate (12 to 14) were at the risk of PU 2.36 times and 1.82 times more compared to other patients, respectively ($P = .001$).[47] According to the results of OR in Table 2, except for first-degree ulcers, the prevalence of PU increased for other degrees, especially necrotic ulcers, with a decrease in Braden score. According to the components of Braden score, the most important reason for the increase in PU due to the decrease in Braden score in our study was the reduction in mobility and activity and then sensory perception. A study conducted in Portugal also showed that except for the nutritional factor, other components of Barden score were associated with the occurrence of PU.[48] Therefore change position of patients and moving their limbs at short intervals could significantly reduce the incidence or progression of PU. As expected in our study, another important factor in the incidence of PU was an increase in LOS. Mean LOS was observed in patients with PU 13.45 (SD = ±12.65) and without PU 10.77 (SD = ±10.96), respectively. According to Figure 3, even in low-risk patients, PU incidence increased with increasig LOS. In his systematic review, Serrano showed that LOS was one of the most important risk factors for PU in studies.[49] A study in Italy found that 12% of COVID-19 patients required hospitalisation in ICUs,[5] so due to the widespread prevalence of coronavirus, with the increase in LOS as the result of lack of definitive treatment for the virus, many patients were found to be more prone to PU. On the other hand, one of the important factors in increasing LOS was the development of PU in patients, especially with high degrees. A study in United Kingdom in 2018 reported that, on average, it took more than 12 months for 50% of all PUs to heal[20] and only 21% of grade 4 ulcers heal within a year of onset. Therefore, by preventing the ulcer to grow worse, the length of patient hospitalisation could reduce, new ulcers could be prevented and existing ulcers could be cured.

The mean age of the participants in this study was 63 (SD = 78.9) years. The prevalence of PU increased with age, which was consistent with most studies and was expected.[50,51] Aging increases susceptibility to PU by decreasing mobility and activity, decreased tissue tolerance decreases, and cellular changes. A systematic review by Serrano showed that in different studies, age was one of the four most important risk factors for PU. Other risk factors included LOS and diabetes[49]. According to the results of the present study, diabetic patients were significantly ($P = 0.002$) more prone to PU, especially grade 2 ulcers. Nasiri et al reviewed 15 studies from different countries and reported that diabetic patients had surgery more than other patients due to bed sore complications.[52]

However, with increasing BMI, patients had significantly more PU ($P = .002$) But in terms of PU degree and ulcer formation areas no significant relationship was observed between the incidence of PU and BMI. According to most studies, patients with low weight (BMI < 18.5) and obese patients (BMI >30) were more likely to develop PU.[53,54] For example, a study in Norway suggested that patients with a BMI below 18.5 were more likely ($P = .020$) to develop PU.[26] One reason for the lack of relationship between BMI and PU in our study could be a significant difference in the mean age of patients in terms of BMI. The mean age of patients with BMI less than 25 was 64 (SD = ±12) years and patients with BMI above 25 was 73 (SD = ±11) years, respectively.

Patients with GCS 3-8 were 1.44 (1.01, 2.09) times more at the risk of developing PU than patients with GCS 13-15. Considering the condition of patients with low GCS, they also had a low Braden score and were more likely prone to develop PU. This finding confirmed the results of most previous research. A study of 1548 patients in Turkey found that patients with GCS less than 10 admitted to ICUs were more likely to develop PU ($P = 0 < .001$). Also in this study, according to our findings, the most common ulcer site was in the sacrum (48%).[55,56] Patients with low GCS had higher LOS and less mobility, therefore, nurses could reduce the incidence of PU in these patients through providing more protection to these patients, such as more frequent movement and mobility of limbs.

267 (83.18%) patients with stool incontinence had PU. Significantly, these patients developed PU in the buttocks and sacrum. Due to the fact that urinary and stool incontinence could cause more PU in these areas,[57] it seems necessary for these patients to be cleaned at short intervals after urination and defecation. With a decrease in haemoglobin, the incidence decreased slightly, although it was not statistically significant. In this study, there was no significant difference between the incidence and prevalence of PU with oedema, movement paralysis, and temperature. Individuals with oedema and paralysis of the limbs had higher Braden score than other patients ($P < .001$) and with increasing temperature, LOS was reduced ($P = .003$).

Patients who took vasopressor had a 2.16 (1.13, 4.14) times odds of developing first-degree PU, however, there was no significant relationship with other degrees of ulcer or for incidence. The role of vasopressor in increasing the incidence of PU was already reported,[58,59] though El-Marsi et al showed that patients taking vasopressors were 0.42 (0.29, 0.87) more likely than other patients to develop PU.[60] Based on the experiences of the COVID-19 pandemic for PUs, it was suggested that, in order to prevent PU, nterventions such as proper skin cleansing, change position and improvement of patient mobility, minimisation of moisture and nutritional modification, and use of pressure relieving support surfaces could be helpful.[50] One of the strengths of the present study was the study of the incidence and prevalence and the study of important variables regarding PU, such as degrees and all common places of PU in patients. In addition, data collection was done very carefully by experienced and trained nurses under the supervision of ulcer supervisors and infectious disease specialists.

5 | CONCLUSION

The incidence and prevalence of PU in patients were high in this study. The length of hospitalisation and Braden score were the most important factors in the development of PU. The widespread prevalence of COVID-19 and the relatively long stay of patients in the ICU created unfavourable conditions for patients and the treatment system, therefore, it emphasised to use of appropriate measures to prevent PU to avoid double costs and longer stays.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The identified datasets analyzed during the current study are available from the corresponding author on reasonable request.

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