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Research Article

RELATIONSHIP BETWEEN BLOOD PRESSURE LEVELS AND THE SEVERITY OF THE CLINICAL PICTURE IN SUSPECTED OR CONFIRMED CASES OF COVID-19

Emilio Dominguez San Martín[1]., León Vázquez María de la Luz[2]., Oscar Castañeda Sánchez[3] and Ma. Angélica Maldonado Rodríguez[4]

[1]Physician Epidemiologist Family Medicine Unit 9 Santa Ana Chiautempan Tlaxcala
[2]Coord. Aux Med Investigation OOAD Tlaxcala
[3]Planning and Institutional Liaison Coordinator OOAD Tlaxcala
[4]Medical Research Unit for Infectious and Parasitic Diseases Siglo XXI IMSS

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A B S T R A C T

Introduction. Chronic diseases share several characteristics with infectious processes, arterial hypertension has been related to the poor evolution of SARS CoV2 infection.
General Objective. To relate blood pressure figures to the severity of the clinical picture is suspected or confirmed cases of CoVID-19 in UMF No. 9, Tlaxcala.
Method. Observational, cross-sectional study. Respiratory care module records were consulted, age, sex, PCR or rapid test, symptomatology, comorbidities, vital signs were obtained, and based on the clinical picture the severity of the infection was classified. Descriptive analysis was performed, in addition to Chi 2, Fischer's exact test, Mann Whitney U test, considering statistically significant $p \leq .05$. Results: The study included 1013 patients, 51% of whom were women, the age range was 18 to 90 years, 4% had a history of hypertension, the mean blood pressure was between 88 and 222 mmHg, 56% had normal blood pressure, the severity of COVID-19 was mild in 75%, moderate in 21% and severe in 4%. Severity was associated with systolic, diastolic, and mean pressure figures ($p<0.05$). Conclusion: blood pressure elevation is associated with COVID-19 severity.

INTRODUCTION

Arterial hypertension (AHT) is the main cardiovascular risk, worldwide, with a prevalence of 26% (Tagle R. 2018). During the 2019 coronavirus disease pandemic (COVID 19), it has been one of the main comorbidities associated with a worse prognosis (Ejaz, *et al*. 2020). Since its inception, it was observed that those patients with comorbidities were more likely to be admitted to intensive care, suggesting that diseases such as hypertension and diabetes mellitus may be related to the pathogenesis of COVID 19, sharing some characteristics such as proinflammatory state and attenuation of the innate immune response (Yang, J *et al*. 2020).

SARsCoV2 virus uses angiotensin-converting enzyme 2 (ACE-2) receptors to enter host cells, so in patients with HAS who use ACE inhibitors, angiotensin II type I receptor blockers, in their control, ACE2 receptor expression is increased and makes them more susceptible to COVID 19 (Fang L, *et al*. 2020). In addition to the effect on ACE2 inhibitors and angiotensin 2 receptor blockers, myocardial damage and dysfunction demonstrated through troponin elevation and electrocardiogram alterations have been proposed as possible mechanisms (Salazar M, *et al*.2020).

Corresponding author:* **Emilio Dominguez San Martín
Physician Epidemiologist Family Medicine Unit 9 Santa Ana Chiautempan Tlaxcala

However, there are controversies related to this association, such as the higher infectivity in older people is not related to ACE2 expression levels and the evidence about differences in plasma ACE2 expression according to sex and age in humans is controversial; it has not been specified whether the use of ACEI or ARA II is of risk or benefit in patients with COVID-19 due to their proinflammatory and prooxidant effect (Choi M, *et al*.2020).

Studies have reported detection of AHT in patients with COVID-19 who required hospitalization in the intensive care unit, being involved in the renin-angiotensin-aldosterone system (RAAS), ACE 2 elevation even in patients with mild or moderate COVID-19 (Perez A, *et al*. 2021). Most studies evaluate the relationship between a history of HT and the severity of the condition, but not the blood pressure levels of patients with COVID-19 in patients without a history of HT. Therefore, the objective of the research was to identify whether there is a relationship between blood pressure and the severity of COVID-19, which will help to continue with the clinical-epidemiological knowledge of the disease.

MATERIAL AND METHOD

An observational, descriptive, retrospective study was conducted, in which, once the protocol was authorized by the Local Health Research Committee, with registration R-2021-2902-035, we reviewed the records of patients who attended the respiratory care module of the family medicine unit No. 9 Santa Ana Chiautempan Tlaxcala, in the period between January 1 and October 30, 2021, we collected personal data (age, sex, occupation, weight, height, etc.). 9 Santa Ana Chiautempan Tlaxcala, in the period between January 1 and October 30, 2021, personal data were collected (age, sex, occupation, weight, height), as well as those related to the disease (symptoms, PCR or rapid test, outpatient or hospitalized management, history of vaccination, brand and number of doses, personal history, integration of pneumonia diagnosis) as well as vital signs including oxygen saturation, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP) was calculated, according to the American Heart Association and American College of Cardiology, blood pressure figures were classified as normal < 120/80, elevated 120-129/<80, hypertension stage 1 130-139/80-89, hypertension stage 2 ≥ 140/90 (Rubio A, *et al*. 2018). Based on the information and according to the COVID treatment guideline 19 (Valdez R, *et al*. 2021) was classified as mild when there was no evidence of pneumonia or hypoxia, SpO2 ≥ 94% on room air, moderate when presenting clinical data of pneumonia (fever, cough, dyspnea, rapid breathing) without signs of severe pneumonia, including a SpO2 ≥ 90%, and severe when they had clinical signs of pneumonia (fever, cough, dyspnea, rapid breathing) plus 1 of the following respiratory rate greater than 30 breaths per minute, severe respiratory distress or SpO2 < 90% on room air. Descriptive analysis was performed for each variable, in addition to chi-square and Mann Whitney U for comparison between groups, with p values equal to or less than 0.05 being considered statistically significant.

RESULTS

We included 1013 patients who attended between January and October 2021 at UMF 9 who met the operational definition of COVID 19, of whom 51.5% (522) were women and 48.5% (491) were men. Age was between 18 and 90 years with a median of 34 and interquartile range (IQR) 16, 95% CI 35.01-36.66.

The 49.5 % (502) of the patients were employees, 4% health personnel (41), 5% (52) housewife, 4% (37) teachers or students, 1% (9) retired and 36% (372) other activity. Among the comorbidities reported, 30% had obesity, 4% (41) had a history of hypertension, 3% (34) diabetes mellitus 2, 2% (23) other (chronic obstructive pulmonary disease, renal, cardiovascular, or smoking).

The 34.6% (351) had received at least one dose of vaccine, 34% (119) had a complete vaccination schedule. According to the body mass index, 25% were obese, 44% were overweight, 29% were normal weight and 2% were underweight.

Twenty-five percent had a sudden onset of the disease, headache, odynophagia, and cough were the most frequent symptoms, and no patient-reported nasal congestion or dysphonia (Table 1).

Table 1 Description of symptoms

Symptom	Frequency (%)	Symptom	Frequency (%)
Headache	803 (79.3)	Sudden Onset	251 (24.8)
Odynophagia	720 (71.1)	Diarrhea	110 (10.9)
Cough	699 (69)	Chest pain	76 (7.5)
Myalgia	527 (52)	Abdominal pain	62 (6.1)
Rhinorrhea	521 (51.4)	Conjunctivitis	48 (4.7)
Fever	460 (45.4)	Dyspnea	36 (3.6)
Arthralgias	397 (39.2)	Prostration	24 (2.4)
General condition attack	370 (36.5)	Cyanosis	2 (0.2)
Chills	349 (34.5)	Polypnea	2 (0.2)
Anosmia	161 (15.9)	Others	9 (0.9)
Dysgeusia	136 (13.4)		

The mean blood pressure reported was between 88 and 222 mmHg According to the blood pressure figures, 56% (565) were found without hypertension, 29% (291) with elevated blood pressure, 13% (134) with stage 1 hypertension, and 2% (23) with stage 2 hypertension (Table 2).

Table 2 Reported vital signs

	Minimum- Maximum	Middle	RIQ	IC 95%
Systolic blood pressure*	61-160	115	11	115.38-116.88
Diastolic blood pressure *	40-100	77	11	75.32 – 76.36
Mean arterial pressure*	88-222	166	18	165.89-167.75
Heart rate**	56-132	80	13	80.21-81.77
Respiratory frequency^{0}	15-30	18	2	18.62-18.96
Temperature^{o}C	34-39.3	36.5	0.6	36.56-36.55
Oxygen saturation (%)	40-99	95	3	94.08-94.96

RIQ interquartile range, *mmHg, ** heartbeats per minute, ^{0}respirations per minute

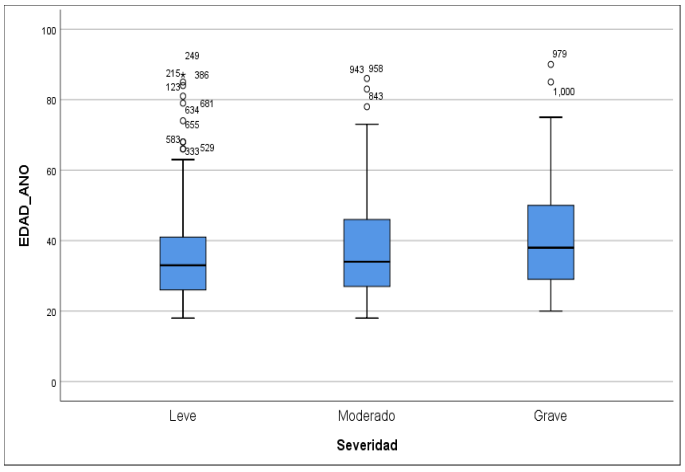
Based on the treatment guidelines for COVID 19, severity was classified as mild in 75% (756), moderate 21% (213), and 4% (44) severe. Significant differences were observed about systolic, diastolic, and mean blood pressure and oxygen saturation (Table 3).

Table 3 Blood pressure and COVID 19

	Mild	Moderate	Severe	p
Systolic blood pressure	110 (10) IC 95% 114.62-116.14	121 (21) IC 95% 118.21-121.22	115 (15) IC 95% 108.08-121.00	0.000
Diastolic blood pressure	75 (10) IC 95% 74.81-75.44	80 (12) IC 95% 77.03-79.08	70 (21) IC 95% 69.09-76.05	0.000
Mean arterial pressure	165 (17) IC 95% 164.61-166.60	171 (23) IC 95% 169.71-173.78	164 (126)IC 95% 154.49-168.84	0.000
O2 saturation	96 (2) IC 95% 95.72 – 95.93	83 (1) IC 95% 92.39- 92.65	88 (6) IC95% 82.51-89.68	0.000

Kruskal Wallis. Median (interquartile range)

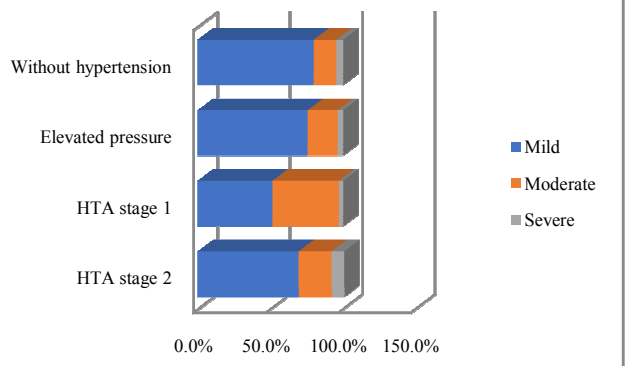
A significant difference was observed between age and COVID 19 severity levels (Figure 1).



There was no statistical difference between systolic blood pressure, diastolic blood pressure, mean arterial blood pressure, or BMI between the suspect and confirmed groups (p>0.05); nor was there a statistical difference between hypertension classification and reason for discharge.

Hypertension classification was associated with the severity of the condition (p 0.000) (Figure 2).

Figure 2. Blood Pressure and COVID 19 severity



Considering only confirmed cases, 59% (60) were male, showing no statistical difference between severity and sex (chi-square 0.684), as well as with vaccination history (chi-square 0.059). With the statistical difference about systolic blood pressure (0.001), diastolic blood pressure (0.005), and mean blood pressure (0.006).

A statistical difference was observed between the severity of COVID and the history of vaccination (chi-square 0.040), 66% of the patients had not yet received COVID vaccine, 30% of the patients with the severe disease did not have a complete vaccination schedule.

DISCUSSION

Comorbidities such as diabetes mellitus and hypertension have been associated with a worse prognosis in patients with COVID19 associated with pre-existing chronic inflammation leading to an extreme systemic inflammatory response (Rajpal A, *et al*. 2020), however, there are some controversies in this regard, studies suggest there is no evidence linking HAS with COVID 19 outcomes (Schiffrin EL, *et al*. 2020), in the present study, higher blood pressure levels were observed in patients with moderate and severe disease.Mudatsir y cols. (2020),in a meta-analysis indicate an association of arterial hypertension with an increased risk of severe COVID-19 (OR 2.33 CI95% 1.42-3.81), mentioning among the clinical manifestations associated with severity the increase in systolic blood pressure (OR 1.84 CI95% 1.31-2.60), coinciding with what was observed, in which a significant difference was observed not only with the systolic blood pressure but also with DBP and MAT.

Yuhui *et al*. (2021), evaluated the impact of hypertension on the severity of COVID-19 in 3400 patients in Wuhan China, separating patients without comorbidities, only with HAS, only with diabetes mellitus, and those with both pathologies, comparing the outcome (death or discharge), where the use of ACE inhibitors and ARA did not present a difference, the presence of hypertension did not increase the risk of mortality.

Marijana *et al* (2021) describe the controversies reported regarding the association of hypertension or blood pressure numbers with COVID 19, pointing out the lack of differentiation between patients with chronic, newly diagnosed, controlled, or uncontrolled hypertension or pressure levels, variables that were not contemplated in the present study either.

Nam, JH cols, (2021), suggest variability in blood pressure figures in patients with COVID-19, analyzed changes in MAT at 8 am and 8 pm calculating a coefficient of variation, reporting that patients with a history of hypertension developed more frequent complications, fluctuation in blood pressure was associated with hospital mortality.

In the present study, the highest blood pressure figures were in the group of patients with moderate disease, in contrast to that reported in the previous study where they mention that variability of systolic and diastolic BP was associated with a higher risk of mortality (Geng L, *et al*. 2021).

Li Geng *et al*,(2021), associated blood pressure levels and mortality in patients with COVID 19 in Wuhan, report that 23% (29/123) of patients admitted to the intensive care unit were diagnosed with stage 1 HAS, 19% with stage two and 18% in stage 3 according to Chinese guidelines, This was related to mortality, with a longer duration of hospitalization, showing a significant difference between patients with stage 3 and those without hypertension, but not between the other groups, coinciding with what was observed, a significant difference was shown between blood pressure and the severity of the COVID picture; One-third of the patients had elevated blood pressure, 13% had stage 1 hypertension and 2% had stage 2 hypertension, although the cohort points were different, as was the population studied since the present study included ambulatory patients who attended a first level unit.

Previous studies have evidenced the association of BMI with the outcome of COVID 19 (Malik VS, *et al*. 2020), however in the present study BMI was not related to the severity of the picture, the only association is demonstrated when separating with and without obesity, being related to arterial hypertension.

The main limitation of the study is the cross-sectional design, in which it is not possible to establish a causal relationship between COVID and elevated blood pressure, in addition to the fact that previous blood pressure treatment was not included (although the percentage of patients with a history of hypertension was low); it is advisable to follow up patients who presented elevated blood pressure during the acute phase of the disease to identify the long-term effect. Another limitation is the dispersion of the population about age, since this is an independent factor for the increase in blood pressure, in addition to not having previous blood pressure figures.

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