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Clinical Characteristics and Evolution of Ventilated Patients Invasively During the First Year of COVID-19 - Descriptive-Observational Study at a Public-School Hospital of Buenos Aires, Argentina

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Abstract

Introduction: SARS CoV-2 infection can cause mild respiratory symptoms to acute respiratory failure, characterized by severe hypoxemia and bilateral infiltrates that require intensive care. Being a new entity with little knowledge in our country, we sought to describe the epidemiological and clinical characteristics, as well as the mortality of patients with mechanical ventilation diagnosed with COVID-19 infection admitted to the Intensive Care Unit (ICU).

Methods: We conducted a retrospective, observational, descriptive study that included patients over 18 years, diagnosed with COVID-19 infection that required invasive mechanical ventilation at the Intensive Care Unit of the Hospital de Clínicas "José de San Martín" in Buenos Aires City during the period between March 25, 2020, and March 25, 2021. Patients under 18 years of age and those who received IMV for more than 24 hours before admission to the ICU were excluded from the study.

Results: 128 patients underwent invasive mechanical ventilation through the study time with 60.94% mortality. The median age was 68 years old (57-76) and the majority were male (57.03%). History of cardiac hypertension was the most commonly found comorbidity (67.94%), followed by diabetes and obesity (23.43%). The Median for APACHE II score was 14 at ICU admission (10-18). The time from symptoms to IMV was 7 days (4-11). The median days of IMV was 14 days (7, 5-23) and the median ICU stay was 16 days (10, 75-26).

Conclusion: This study will allow us to know the epidemiological, clinical and mortality characteristics during the first year of the pandemic, which could facilitate the planning of future therapeutic strategies and the use of resources. Randomized prospective studies are needed to gain more knowledge about the approach to this population.

Keywords: Acute Respiratory Distress Syndrome; Coronavirus; Mechanical Ventilation; Critical Care

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Introduction

On December 31, 2019, a series of cases of pneumonia of unknown origin in the city of Wuhan, China was reported. On February 11, 2020, the disease-causing agent called Sars COV-2 was identified [1]. This was isolated from biological samples and identified as Beta Coronavirus genus, placing it with others such as severe acute respiratory syndrome and the Middle East Respiratory Syndrome [2]. Infection by the Sars Virus COV-2 can cause slight respiratory symptoms to a picture Acute respiratory failure, characterized by severe hypoxemia and bilateral infiltrates, requiring intensive care [3].

The World Health Organization (WHO) declared Pandemia on January 30, 2020, confirming Argentina the first case on March 3 of the same year [4]. At the end of the study period, 2,291,051 cases with more than 55,000 deaths in the country. This situation led to the limit of health resources, reaching August 2020 a percentage of the ECI beds of almost 70% [5,6].

Numerous international studies reported data from patients affected by this pathology, in terms of its characteristics and evolution of it. However, in our country the information is scarce, so observing the characteristics and evolution of patients admitted to the UTI of the José de San Martin Hospital (HCJSM) could facilitate the planning of future therapeutic strategies and the use of resources.

Therefore, the objective of this work is to describe the epidemiological, clinical and mortality characteristics of ventilated patients invasively diagnosed with COVID-19, and admitted to the UTI of the HCJSM in the period between March 25, 2020, and March 25, 2021.

Materials and Method

A descriptive, observational, retrospective study that included patients diagnosed with COVID-19 who required invasive mechanical ventilation (VMI), admitted to the UTI of the HCJSM of the city of Buenos Aires in the period between March 25, 2020, and March 25, 2021.

The HCJSM is a university hospital, versatile, which has a UTI with 30 beds of which 20 were used for the care of patients diagnosed with COVID-19, divided into 2 rooms. The medical body is formed by plant doctors and residents, the nursing service has a 1:2 nurse-patient relationship, while the kinesiologist-patient is 1:5. The UTI has Micro processed Fans Drager® Avita XL, Drager® V300, Maquet® Servo-S, Tecme® Neumovent TS and Mindray® SV300. The data were registered in a daily monitoring form for each patient and followed up to high or death. All the variables were entered into a database by the same person.

Patients who entered the UTI were included in the study period with a confirmed diagnosis of COVID-19, using a polymerase chain reaction test with reverse transcriptase (RT-PCR) positive for SARS-COV-2 in Hiopap Nasopharyngeal or oropharyngeal, by the WHO guides with VMI requirements [7]. Patients under 18 years of age and those who received VMI for more than 24 hours before entering UTI were excluded from the study.

The variables that were recorded on day 1 of admission to UTI were: demographic data (age, sex, personal history), degree of severity according to the Apache II score (Acute Physiology and Chronic Health Evaluation) [8], and development of respiratory distress syndrome Acute (ARDS) with the data of the first 24 h [9]. PAO2/FIO2 and ventilatory parameters (Plateau pressure, positive pressure at the end of expiration -Peep- Total, Delta Pressure and Complence of the respiratory system -CRS-) The first, third, fifth and eighth days were taken. The beginning of symptoms according to the Ministry of Health of the Nation to VMI [10], Tidal volume (VT) in ml/kg of the predicted body (PCP), use of prone position therapy, days of analgesia, sedation, Neuromuscular and coma blockers, patients with a tracheotomy requirement (TQT), VMI days until its realization, weaning classification according to WIND [11], VMI days and stay in UTI, and state at the discharge (live or Óbito). All these variables are described in the supplementary material.

This study was evaluated by the Ethics Committee and the HCJSM Teaching and Research Committee. Through the coding of the data, the confidentiality of the patient's personal information was protected and due to the retrospective nature of the study, informed consent was not required. The authors did not report conflicts of interest.

A descriptive analysis of the variables was performed. The categorical variables were presented as absolute numbers and percentages. The continuous variables that assumed a normal distribution were presented as average and standard deviation. Otherwise, they expressed themselves as median and interquartic range (RIQ). To verify the distribution of the sample, the Kolmogorov-Smirnov test was used. Those values with a value of $p < 0.05$ were considered statistically significant. For data analysis, IBM SPSS Macintosh software, version 20.0 (IBM Corp. Harmon, NY, USA, was used).

Results

In the period between March 25, 2020, and March 25, 2021, 161 patients with confirmed Diagnosis of COVID-19 were registered that VMI required, of which 33 were eliminated by receiving VMI for more than 24 hours before entering Uti. Finally, 128 patients met the criteria and were included.

The median age was 68 years (57-76) and the total sample, 73 (57.03%) were male. The background that occurred most frequently was arterial hypertension (HT) in 53 (67.94%) patients, followed by diabetes (DBT) and obesity both with 30 (23.43%). The median Apache II at the entrance was 14 (10-18). The median days from the beginning of symptoms until VMI was 7 (4-11). The median VMI days in the total population was 14 (7.5-23), in the patients who died was 16 (10-23) and in which they survived it was 9 (6-20). The median stay in UTI of the total population, alive and dead was 16 days, with an RIQ of 10.75-26; 10-26.75 and 11, 25-24.50 respectively.

In total 78 (60.46%) patients required prone position therapy at least once. 21 (16.40%) tracheotomies were performed, having a median VMI day until its realization of 23.50 (18-27). Mortality was 60.94%. All these variables are found in Table 1.

About the days of analgesia, sedation and neuromuscular blockers (BNM) in the total sample, a median day of 12 (7-20.50), 11 (6-18) and 5 (1.50 -10), respectively. Table 2 shows the days of analog sedation, BNM and coma in surviving and not surviving patients. According to Berlin's criteria, ARDS developed in 118 (92.18%) patients.

The VT in ml/kg of PCP, pulmonary mechanics, pao2/fio2, need for prone positions, days of VMI, and mortality are found in Table 3.

Regarding Weaning, 69 (53.90%) patients did not make any separation attempts. The patients corresponding to the G1 group were

Tabla I. Variables epidemiológicas y clínicas.

Características	Total (N= 128)	Sobrevivientes (N= 50)	No sobrevivientes (N= 78)
Edad, mediana (RIQ)	68 (57-76)	60 (49-67)	72 (65,5-78)
Sexo masculino, n (%)	73 (57,03)	27 (54)	46 (59,97)
Antecedentes, n (%)			
Cardíacos	61 (47,65)	17 (34)	44 (56,41)
· HTA	53 (67,94)	15 (30)	38 (48,71)
· IC	6 (4,68)	1 (2)	5 (6,41)
Respiratorios	51(39,84)	16 (32)	35(44,87)
· EPOC	14 (10,93)	2 (4)	12 (15,38)
· Asma	6 (4,68)	1 (2)	5 (6,41)
· Tabaquismo	15 (11,71)	6 (12)	9 (11)
· Ex tabaquismo	21 (16,40)	5 (10)	16 (20,51)
Neurológico	15(11,71)	8 (16)	7 (8,97)
Obesidad	30 (23,43)	11(22)	19 (24,35)
Diabetes	30 (23,43)	6(12)	24 (30,76)
Otros	78 (60,93)	31(62)	47 (60,25)
APACHE II de ingreso, mediana (RIQ)	14(10-18)	13 (10-16)	15 (11-19)
Días de síntomas hasta VMI, mediana (RIQ)	7 (4-11)	7 (3-10)	7 (4-12)
Días de internación en UTI, mediana (RIQ)	16(10,75-26)	16(10-26,75)	16 (11,25-24,50)
Días de VMI, mediana (RIQ)	14 (7,5-23)	9 (6-20)	16 (10-23)
Prono, n (%)	78 (60,93)	17 (34)	61 (78)
Pacientes TQT, n (%)	21 (16,40)	10 (20)	11 (14,10)
Días de VMI hasta TQT, mediana (RIQ)	23,50 (18-27)	26,50 (18,25-29,50)	21,50 (18,80-24,75)

N: cantidad de pacientes; RIQ: rango intercuartílico; HTA: Hipertensión arterial; IC: insuficiencia cardíaca; EPOC: Enfermedad pulmonar obstructiva crónica; VMI, ventilación mecánica invasiva, CNAF, cánula nasal de alto flujo; UTI: Unidad de Terapia Intensiva; TQT, traqueotomía.

Tabla II. Días de analgesia, sedación, bloqueantes neuromusculares y coma.

	Sobrevivientes (N=50)	No sobrevivientes (N=78)
Analgesia, mediana (RIQ)	9 (5-17,75)	14(9-21)
Sedación, mediana (RIQ)	7,50 (5-13,75)	14(9-21)
BNM, mediana (RIQ)	2 (0-4)	8 (4-13)
Coma, mediana (RIQ)	7 (4-12,75)	14 (9-20)

N: cantidad de pacientes; RIQ: rango intercuartílico; BNM: bloqueantes neuromusculares.

Tabla III. Grados de severidad de SDRA

		Severidad de SDRA		
	Total	Leve	Moderado	Severo
Severidad de SDRA, n (%)	118	14(11,86)	62(52,54)	42(35,59)
VT de inicio de VMI, mediana (RIQ)	6,71(6,11-7,03)	6,73(6,24-7,02)	6,87(6,19-7,05)	6,64(6,03-6,99)
Presión Plateau (Cm H2O), mediana (RIQ)				
· Día 1	23,50 (21-25,25)	20(19-24)	24(21-25)	24(22-26)
· Día 3	23(21-24)	22(20,5-25,5)	23(21-24,25)	23(22-24)
· Día 5	23 (21-25,25)	22(20-27)	23(21-25)	24,50(22-26,75)
· Día 8	24 (22-26)	22(21-25)	24(21-26)	25(24-26,75)
Peep total (Cm H2O), mediana (RIQ)				
· Día 1	11(8-13)	8 (7-12)	11(9-13)	11(8-13)
· Día 3	12(10-13)	10(8-12)	12(10-13)	12.50(10,75-14)
· Día 5	11(9-13)	8(8-10)	11(9-12)	12(11-14)
· Día 8	11(9-13)	10(7-10)	11(9-12,50)	13(10,25-14)
DP (Cm H2O), mediana (RIQ)				
· Día 1	12(10-14)	12(12-13)	12-(10-14)	13(11-14)
· Día 3	11(9-13)	13(9-16)	11.50(9-13)	11(9-12)
· Día 5	12(10-14)	14(9-18)	13(10-14)	11,50(10-14)
· Día 8	13(11-15)	14(12-15)	13(11-14,50)	12,50(10-14)
Compliance (Ml/cm H2O), mediana (RIQ)				
· Día 1	32,40(27,53-42,85)	34,1(30,70-40,9)	32,70(28,50-44)	30,95(24,33-37,50)
· Día 3	39,10 (30-46,30)	40(27,40-48,25)	39,55(30,60-50)	37,10(30-42,60)
· Día 5	35 (27,90-44,55)	33,3(28-45)	36,30(31,40-45)	33,65(26,45-44,13)
· Día 8	34,25(26,68-42)	33,5(29,3-57)	36,60(27,55-42,65)	32,20(24,05-41,90)
PaO2/FIO2, mediana (RIQ)				
· Día 1	121,50(87,25-160,25)	230(217,75-254)	139 (121-160,25)	77,50(65,10-89,50)
· Día 3	203 (160-252)	194(169-239,75)	197,50(161-242,75)	228(146-260)
· Día 5	183,50(142,95-222)	172,5(148,25-204,25)	189(163,25-220)	170(123,75-222,75)
· Día 8	187(140-227)	168(123-193)	182(140-227)	191,50(152-229)
Prono, n (%)	76 (64,40)	5 (35,71)	36 (58,06)	35 (83,33)
Ciclos de prono, mediana (RIQ)	1(0-2)	0(0-1)	1 (0-2)	1(1-3)
Días de VMI, mediana (RIQ)	14 (8-23)	12,50(8-24,50)	14 (7,25-21,75)	14,50(9-23)
Mortalidad, n (%)	73 (61,86)	9 (64,28)	36 (58,06)	28 (66,66)

N: cantidad de pacientes; RIQ: rango intercuartílico; PCP: Peso corporal predicho; SDRA: Síndrome de distrés respiratorio agudo; VMI: Ventilación mecánica invasiva; DP: Driving pressure.

35 (27.34%), 4 (3.12%) patients belonging to Group G2, 11 (8.59%) to G3A and 9 (7.03%) to the G3B group. VMI days until the first separation attempt were 7 (5-13), 6 (2-12.25), 13 (9.50-21.50) and 8 (5-9) for the respective groups. In the graph, you can see the differentiated patients in survivors and not survivors according to the weaning group.

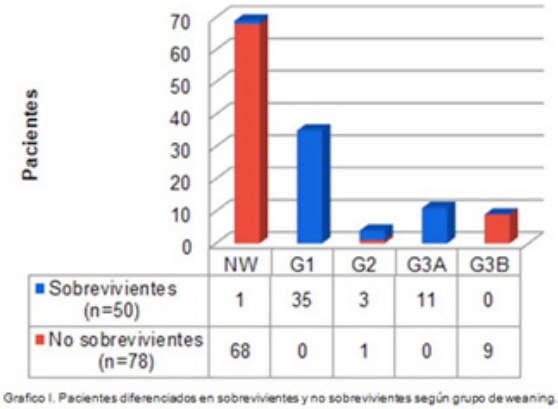

Grafico I. Pacientes diferenciados en sobrevivientes y no sobrevivientes según grupo de weaning.

Discussion

In this study we found that the population was a median age of 68, being mostly male with an Apache II at the entrance of 14 (10-18). The most prevalent history was HTA, DBT and obesity, with mortality of 60.94%.

Compared to other studies, the median age was similar to what literature [12-14], but greater than what is reported [15-17], being similar to what is found in a previous study made on the UTI of the HCJSM [18]. Both in our study and the bibliography consulted, the male and HTA sex were more prevalence [12-17]. As for DBT, it was presented with the same frequency as reported [12,14,15, and 17].

The percentage of obesity was lower than in an Argentine epidemiological study [15].

In the total cohort, it was observed that VMI's median days were 14, being considerably greater than the lung safe, an epidemiological study carried out in distressed patients did not Covid-19 [19]. When comparing the data with work in the Covid-19 population, we found that these values were greater than those reported by Plotnikow G, et al. (2020) [16], and Bhatraju PK, et al. (2020) [20], although similar to what other authors [12,14,15,17, and 21].

The patients who required to be ventilated in pronus were 78 (60.93%) being higher than reported by the Lung SAFE (7.90%) [19], Yang X, et al. (2020) [22], (11.50%) and Botta M, et al. (2021) [12], (25 %), similar to another [3,15], although less than a Spanish epidemiological study (76 %) [14]. The use of this therapy could be attributed to the largest number of patients categorized as moderate and severe, being the median PAO2/FIO2 of day 1 less than 150.

The percentage of tracheotomized patients was similar to Botta M, et al. (2021) [12], and Hur K, et al. (2020) [23], but less than what was observed in other studies [13,15, and 17]. As for the VMI days until its realization, it was similar to what was observed in a study in two

Massachusetts centers with a median of 22.5 days [17]. On the other hand, it was considerably greater than a cohort of unpublished patients from Our institution (16.5 days) and what Estessor. Tracheotomy is a procedure that generates aerosolization, so health workers run the risk of infection being a challenge, and subsequent handling and care to minimize nosocomial transmission risk [25].

The mortality reported in our study was similar to two epidemiological studies carried out in our country [15,16], but greater than what was informed in work carried out in Holland, Spain and the US [12,14,17, and 23]. when observing the characteristics of the population of these Studies, we find that age, the reports reported and medium-sized days of VMI were similar to what is found in our sample, so we believe that this difference could be due to socio-economic characteristics since they are developed countries. The mortality percentage was not represented by the median Apache II obtained, which was taken within the first 24 h from the entrance and may not reflect the evolution of the cohort.

Regarding the ventilatory mechanics parameters of the patients who met the criteria of ARDS (92.18%), it was observed that the VMI start VT was less than 8 ml/kg of PCP, being inferior to what Bellani G, et al. (2016) [19], (6.71 vs 7.60 ml/kg respectively) but similar to other epidemiological studies in patients with COVID-19 [12,14, and 15]. Patients who were initially classified as slight moderate and severe, unlike what was shown by Ferrando C, et al. (2021) [14], who reported similar total PEEP values between the different degrees of severity of ARDS [14]. It could be due to the need for higher levels of PEEP to increase oxygenation values in patients more seriously. This difference was not observed in the DP and Complence values.

Regarding the separation of the VMI, of the total sample studied more than half did not make attempts to separate, in turn about 90% of the non -survivors either. The deceased patients had twice as many days as the Criteria for starting Weaning. The median age, the percentage of comorbidities, the Prono recumbency requirement and the VMI days were greater concerning the survivors, which can explain these results. On the other hand, those patients who survived managed to get mostly disconnected (70%) after the first attempted separation.

As strengths of the study, we can mention the size of the sample obtained and the low loss of data, which were entered into a form by a single person. In addition, patient monitoring could be performed throughout the stay in UTI. The Weaning classification according to WIND allowed us to classify patients with failed weaning, unplanned and tracheotomized extubations.

Within the limitations, we can mention that data collection was made by different kinesiologists. The background classification was selected based on the criteria of the authors to facilitate data collection, which did not allow us to compare them totally with the studies consulted. On the other hand, in our sample, the antecedent of obesity was registered through the medical records, while in the other studies it was objectively evaluated and measured by the body mass index.

Finally, it should be noted that the HCJSM received derivations from other institutions during the pandemic. The high occupation of beds in UTIs could have affected the care provided to patients.

Conclusion

The patients who entered the study period and received VMI were a median age of 68 years, mostly men, being the most prevalent background HTA, DBT and obesity. The median VMI days and stay in UTI were 14 and 16, respectively. The total mortality of the sample was 60.94%. This study allowed us to know the epidemiological, clinical and mortality characteristics during the first year of the pandemic. Randomly prospective studies are needed to obtain more knowledge about the approach to this population.

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Supplementary material Description of variables:

- Income filiatric data: age and sex.
- Personal history: taken from the patient's medical history. They were subdivided into 6 categories (cardiac, respiratory, neurological, diabetes, obesity and others). In the heart and respiratory categories, entities that were presented most frequently were recorded.
- Apache II of income, calculated with the data of the first 24 h [8].
- Days from the beginning of symptoms to VMI: taking day 1 as the registration of a symptom or more, included in the suspicious case definition of the Ministry of Health of the Nation [5].
- VMI days: They were considered every day when the patient has received VMI from his entry to the UTI to the exit of the same, taking the first day as day [1].
- Tidal volume (VT) in ml/kg predicted body weight (PCP): taking into account the VT with which the first base acid base was taken.
- PAO2/FIO2: Registered on the first, third, fifth and eighth day from the beginning of the VMI with the value of PaO2 of the first routine base acid.
- Variables of ventilatory mechanics recorded to the first, third, fifth and eighth day from the beginning of the VMI, taken in VC CMV mode with quadratic curve:

a. Presción Plateau (PPLAT): Making a telespiratory pause of at least 2 seconds.

b. PEEP Total: Obtained from a Telespiratory Pause of at least 2 seconds.

c. Driving Pressure (DP): It was calculated as the difference between the PLAT and the total peep.

d. Static compliance: calculated from the quotient between the VT and the DP.

- Prono cycles: number of sessions in which the patient was ventrally ventral for at least 16 consecutive hours. The patients were organized according to the criteria of Proseva [26].
- Days of analgo-sedation (AS) and neuromuscular blockers (BNM): number of days in which patients received this type of continuous infusion pump medication in at least one of the two monitored daily records.
- Coma days: number of days when patients presented at least one daily registration of RASS of - 4 or -5.
- Patients with tracheotomy requirements.

- VMI days until the tracheotomy: taking as day 1 the beginning of the VMI.
- Weaning according to the Wind 11 classification.
- Days of hospitalization in UTI: Those days in which the patient remained in the UTI, taking the day of their admission as one day and the last as the day of high or death.
- High state: live or dead.
- Degree of severity of acute respiratory distress syndrome (ARDS): It was classified according to Berlin 9 criteria.

Declarations

The authors declare that they have no conflicts of interest, that the work has been approved by the ethics committee responsible in the workplace, and do not declare means of financing of the work carried out.

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