Prognosis in COVID-19: Impact of Pre-hospital Emergency Care

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Abstract

Background: Since the beginning of COVID-19 disease, each country has planned a consensus for patient management according to its health system. In Tunisia, Pre-hospital emergency care (PEC) worked in regulating and transporting COVID-19 patients. On the other hand, some patients have chosen to consult the Emergency Department (ED) themselves. Does the way to get to medical care have an impact on the prognosis?

Methods: This is a retrospective descriptive study carried out in the Intensive Care Unit (ICU) of Abderrahmane Mami's hospital for nine months (from March to November 2020). Patients included were those who were hospitalized for SARS-COV2 infection by PEC (Group1 (G1)) and those admitted via the hospital's ED (Group2 (G2)). The primary endpoint was mortality.

Results: We included 60 patients: 30 for each group. The average age was 62 years for G1 and 63 years for G2 (p=0.18) with a male predominance in both groups (p=0.4). The most common histories were hypertension (14 cases in G1 and G2, p=1), diabetes (10 cases in G1 and 8 cases in G2, p=0.75), and obesity (14 cases in G1 and 12 cases in G2, p=0.55). Patients in G2 consulted the emergency department later with a mean time from symptom onset to hospitalization of 9.6 days (vs. 6.5 days for G1, p=0.02). On admission, they were more asthenic (p=0.024), with a mean spo2 of 89% (vs. 95% in G1, p=0.008). Patients of PEC had less requirementforo mechanical ventilation (11 cases vs. 21 in G2, p=0.01). Mortality was significantly higher in G2 patients (21 cases vs. 10 in G1, p=0.04). By multivariate study, the way to get to the ICU (group 1 or 2) was not significantly associatewithto mortality and only the requirement of mechanical ventilation was (p<0,001; OR = 16,286 and 95% CI [18,406-3801,272]).

Conclusion: COVID-19 patients admitted to the ICU via PEC had earlier management compared with patients admitted via the ED; they had less serious symptoms with less mortality.

Keywords: COVID-19; Emergency Department; Intensive care unit; Mortality; Pre-hospital Emergency Care.

INTRODUCTION

In 2020, the exponential transmission of COVID-19 disease to an unprotected population threatened the stability of many health systems in the world, which were regularly described as being on the verge of collapse. In this regard, there was no standardized international approach to preserve health structures (1). Each country had planned a consensus for the care of its patients according to its health system, striking the right balance between health protection and the prevention of economic and social disorders**.**

In Tunisia, Pre-hospital Emergency Care (PEC) was the cornerstone of management of the first affected cases of COVID-19. After contacting 190 for a suspected or confirmed COVID-19 infection, An Emergency Mobile Unit (EMU) with protective equipment was moved the patient's home for examination, gravity evaluation, and then to direct him toward most appropriate hospital structure. Other patients did not call 190 and had chosen to go into the emergency department (ED) for various symptoms related to COVID-19 disease. The question was: Was it necessary to stay at home and call 190 for COVID-19 patients? Was it better to go immediately to the ED? The aim of our study was to evaluate the contribution of PEC intervention on the prognosis of COVID-19 patients hospitalized in the Intensive Care Unit (ICU) by comparing that to patients admitted through the ED.

METHODS

It was a retrospective observational study conducted in the ICU of Mami's hospital during a period of nine months (from March 2020 to November 2020). We included patients hospitalized in the ICU for a suspected COVID-19 disease through the ED of the same hospital and those who were transferred from their homes by the EMU. We did not include patients admitted from other structures or hospitals.

Were excluded patients in whom the diagnosis of COVID-19 was infirmed and those with missing data. The primary outcome was in-hospital mortality the and secondary outcome was the requirement of invasive ventilation. We defined two groups: Group 1: Group "PEC": Patients admitted to the ICU through EMU after contacting the PEC and Group 2: Group "ED": Patients admitted to the ICU after coming to the ED frinome with their own ways.

We applied the same therapeutic protocol for both groups according to international recommendations available. Data collection was carried out on a pre-established sheet.

For the statistical analyses, a comparison of two means was performed using the Student's t-test for independent series and by Pearson's chi-square test in case of invalidity of this test. The anonymity and security of the patients' personal data were respected. No data relating to ethnic origin, sexual life or morals were collected. We declare that there was no conflict of interest.

RESULTS

From March 2020 to November 2020, 132 patients were admitted to the ICU with CIVID-19 infection, 70 were not included because they were transferred from another hospital or from another department other than ED. Two patients

were excluded because of missing data and 60 were included in the study.

1. Descriptive study

The two groups were similar on epidemiological characteristics as represented in table 1. The median age was 63 years [57-72]; 62 [54-73] for group 1 and 64 [58-72] for group 2 (p = 0.7). Our population was divided into 41 men (68%) and 19 women (23%), with a clear male predominance, getting a gender ratio of 2.16 (p = 0.4). Twenty-one of the patients (35%) had no known pathological medical history. Hypertension was the most common history found: 46.7% of patients; 14 (47%) of group 1 and the same for group 2 (p=1). Ten patients had pulse oximeter at home (16.7%), without difference in the two groups (p=1). The most reported functional sign was headache, found in 55(91.7%) patients, 29 (97%) from group 1 and 26 (87%) from group 2, i.e. p = 0.1. Fever was reported by 40 patients, i.e. 80% of the population; 23 (77%) from group 1 and 25 (83%) from group 2, i.e. p = 0.4. The two groups were comparable on the symptomatology described, except for dyspnea and asthenia; these two signs were more described in the "ED" group. In fact, 29 patients (97%) in the “ED” group had dyspnea versus 12 (40%) in the “PEC” group; p<0.01. Twenty-eight patients (83%) of the “ED” group were asthenic versus 17 (57%) of the “PEC” group; p=0.02. The average duration between the date of onset of symptoms and hospitalization in the ICU was 8 ± 5 days. This period was shorter in the “PEC” group; 7 days ± 6 in comparison with the “ED” group; 10 days ± 4 i.e. p=0.02. The average duration between the date of onset of symptoms and the date of performance of the COVID-19 PCR on nasopharyngeal swab was 7 ± 5 days. This duration was shorter in the “PEC” group; 6 days ± 6 versus 9 days ± 4 in the “ED” group, i.e. p=0.05. The average time spent in the emergency room before being admitted to intensive care was calculated at 23 ± 16 hours. The latter was statistically longer than the extended time between the PEC call and the patient's arrival in the department, which was 3 hours ± 3 or p < 0.01. Patients in the “ED” group had more serious initial clinical features; the mean initial SpO2 was 83% for the “PEC” group versus 66% for the “ED” group, i.e. p < 0.01. All the patients in the “ED” group had ARDS on admission, versus 18 (60%) in the “PEC” group, i.e. p < 0.01. Table 2 details clinical features, therapeutic characteristics and evolution in the ICU of the two groups. Twenty-one patients (70%) in the “ED” group were intubated in the ICU department versus 11 (37%) for the “PEC” group, i.e. p=0.01. Acute renal failure appeared in 53% of cases (n=32) and it was significantly higher in the "ED" group compared to the "PEC" group (67 vs. 40%, p=0.04). Multiple organ dysfunction syndrome was in 25 patients, more marked in hospitalized emergency patients (60 vs. 23%, p=0.04). The evolution was favorable for 29 patients but fatal for 31 (52%). Mortality was significantly higher in the “ED” group compared to the “PEC” group (70 vs. 33%, p=0.04).

Table 1 *Descriptive study and differences between the two groups before ICU.*

		General population (n = 60)	Group 1 Group "PEC" (n = 30)	Group 2 Group "ED" (n = 30)	P
Demographic characteristics	**Gender-ratio**	2,16	1,73	2,75	0,4
	Median age (years)	63[57,72]	62[54,73]	64[58,72]	0,7
	BMI > 30 n (%)	26 (43)	14 (47)	12 (40)	0,5
	Diabetes n (%)	18 (30)	9 (30)	8 (27)	0,7
	HBP n (%)	28 (47)	14 (47)	14 (47)	1
	Self-monitoring by pulse-oximeter n (%)	10 (17)	5 (16)	5 (16)	1
Clinical characteristics before ICU	**Fever n (%)**	48 (80)	23 (77)	25 (83)	0,4
	Cough n (%)	41(68)	21 (70)	20 (67)	0,7
	Dyspnea n (%)	**41 (68)**	**12 (40)**	**29 (97)**	**< 0,01**
	Asthenia n (%)	**42 (70)**	**17 (57)**	**25 (83)**	**0,02**
	Diarrhea n (%)	6 (10)	5 (17)	1 (3) 0,09	0,09
Therapeutic characteristics before ICU	**Nasal oxygen cannula n (%)**	16 (27)	11 (37)	5 (17)	0,08
	High concentration oxygen mask n (%)	**37 (62**	**12 (40)**	**25 (83)**	**< 0,01**
	Non-invasive ventilation n (%)	**6 (10)**	**0**	**6 (20)**	**0,01**
	Invasive ventilation n (%)	1 (2)	1 (3)	0	0,31
Access to medical care delays	**Time from onset of signs to ICU admission (days) Mean ± SD**	**8 ± 5**	**7 ± 6**	**10 ± 4**	**0,02**
	Time from onset of signs to PCR (days) Mean ± SD	**7 ± 5**	**6 ± 6**	**9 ± 4**	**0,05**

BMI *Body mass index*, HBP High blood pressure, ICU Intensive Care Unit, PCR Polymerase Chain Reaction, PEC Pre-hospital Emergency Care, SD Standard Deviation.

Table 2 *Descriptive study and differences between the two groups in the ICU.*

		General population (n = 60)	**Groupe 1 Group "PEC" (n = 30)**	**Groupe 2 Group "ED" (n = 30)**	**p**
Initial clinical features in ICU	**ARDS n (%)**	**48 (80)**	**18 (60)**	**30 (100)**	**< 0,01**
	Severe ARDS n (%)	27 (45)	10 (30)	17 (57)	0,07
	HR bpm Mean ± SD	91 ± 16	90 ± 14	91 ± 18	0,7
	MBP mmHg Mean ± SD	94 ± 15	94 ± 16	94 ± 14	0,9
	SpO2 (%) Mean ± SD	**74 ± 22**	**83 ± 19**	**66 ± 22**	**< 0,01**
Therapeutic characteris-tics in ICU	**HFNC therapy n (%)**	14 (23)	5 (17)	9 (30)	0,2
	Non-invasive ventilation n (%)	**32 (53)**	**8 (27)**	**24 (80)**	**<0,001**
	Ventral Decubitus n (%)	**36 (60)**	**9 (30)**	**27 (90)**	**<0,001**
	Invasive ventilation n (%)	**32 (53)**	**11 (37)**	**21 (70)**	**0,01**
	Therapeutic-dose Anticoagulation n (%)	60 (100)	30 (100)	30 (100)	1
	Antibiotic therapy n (%)	58 (97)	28 (93)	30 (100)	0,1
	Vitamins therapy n (%)	60 (100)	30 (100)	30 (100)	1
	Corticosteroids n (%)	**54 (90)**	**24 (80)**	**30 (100)**	**0,01**
Evolution in ICU	**Acute renal dysfunction n (%)**	32 (53)	12 (40)	20 (67)	**0,04**
	Severe sepsis n (%)	32 (53)	12 (40)	20 (67)	**0,04**
	Multiple organ failure n (%)	25 (42)	7 (23)	18 (60)	**0,04**
	Mortality n (%)	31 (52)	10 (33)	21 (70)	**0,04**

ARDS Acute respiratory distress syndrome, HFNC High Flow Nasal Cannula, HR Heart rate, ICU Intensive Care Unit, MBP Mean Blood Pressure, PEC Pre-hospital Emergency Care, SD Standard Deviation.

2. Analytic study:

Mortality factors in univariate analysis:

Intra-hospital mortality was about 52 %. In univariate analysis, 8 factors leading to mortality were identified (p; OR; 95% CI): Age (0,006; 3,221; [2,729-15,622]), Delay in access to medical care (<0,001; 4,381; [2,087-9,197]), First SpO2 (0,001; 4,377; [20,873-38,395]), Group "ED" (0,004; 2,222; [1,217-4,059]), ARDS (0,001; 1,706; [1,256-2,316]), Acute kidney injury (<0,001; 5,906; [2,355-14,812]), Invasive ventilation (<0,001; 26,250; [3,823-180,258]) and Multiple organ failure (<0,001; 5,833; [2,816-12,085]).

Multivariate analysis showed that only invasive ventilation was directly related to mortality with p<0,001; OR = 16,286 and 95% CI [18,406-3801,272].

DISCUSSION

Our study showed that patients of group 2 "ED" had later management compared to "Pthe EC" group with a greater delay between the onset of symptoms and ICU admission (OR = 0.31, CI [0.370.77], p= 0.02). And this delay was on average **8 ± 5** days. Armstrong noted, in a meta-analysis of 24 observational studies including 10150 patients admitted to intensive care, that the median time from onset of illness to dyspnea was 5 to 8 days, and the median time from onset of illness to admission to intensive care was 4 to 8 days. The median time from onset of illness to admission to intensive care was 10 to 12 days (2); this was true for all types of transport for patients admitted to the ICU.

Dyspnea was more described in the "ED" group (p<0.01). It was the only symptom significantly associated with both severe COVID-19 (OR 3.70, 95% CI 1.83-7.46) and ICU admission (OR 6.55, 95% CI 4.28 to 10.0) according to a meta-analysis investigating the predictive factors of severe COVID-19 and ICU admission (3).

According to a study done at Tongji Hospital in China in January 2020, which included 344 COVID-19 patients admitted to the ICU, dyspnea was more frequent in non-survivors (p<0.001), accompanied by a higher respiratory rate and a lower SpO2/FIO2 (S/F) ratio (p<0.001)(4). In our study, 80% of patients were in ARDS. The patients who came from the ED (group 2) were all in ARDS however only 60 % of group 1 patients were in ARDS (p<0,01). These results are consistent with the Chinese experience in Wuhan where 81% of patients admitted to the ICU had ARDS (5). A review of the literature comparing ARDS due to COVID-19 with conventional ARDS found that ARDS due to COVID-19 appears to have a poorer prognosis than conventional ARDS, where ICU mortality was 35.3% (95% CI, 33.3% to 37.2%) (6), whereas it ranged from 26% to 61.5% for ARDS secondary to COVID-19, and could be as high as 94% if mechanical ventilation was used (7).

This fact could explain why the requirement of mechanical ventilation (OR = 0.33, CI [0.09-0.58], p= 0.01), as well as mortality (OR = 0.37, CI [0.12-0.61], p= 0.04) were statistically higher in group 2 patients (ED). Group 2 patients were carried out later so they were consulting ED with more developed symptoms and severe hypoxemia. That may be explained by the fact that these people were denying their disease during that period of the pandemic COVID-19 illness. However, group 1 patients were more attentive to their health, so they were in contact with the PEC from the first symptom. PEC was available to go to patients' homes in order to evaluate patients, confirm the diagnosis, and to insist on preventive measurements. So PEC patients were carried out earlier with a better prognosis.

Diagnosis by PCR was made later in the ED group (OR = 0.19, CI [0.02-0.06], p= 0.05). Initial intervention time was longer in the ED group (p< 0.01).

Moreover, the time spent by the SMUR teams with the patient before bringing him back to the department was significantly shorter than the time spent in the emergency department before hospitalization in the intensive care unit (3 vs. 7 hours, p<0.001).

Impact of Pre-hospital Emergency Care on COVID-19 prognosis

Pre-hospital care and management of COVID-19 patients is an important step in the first assessment, triage, and packaging of patients, besides the contribution to the control of the virus spread. Our study showed that medical transport of COVID-19 patients admitted to the ICU with ARDS reduced mortality when patients are hospitalized early with few symptoms and less ARDS compared with patients admitted via the ED. Few studies evaluating the impact of pre-hospital COVID-19 patients' care on their prognosis are available. Feedbacks on pre-hospital emergency transport and care of COVID-19 Patients were described (8,9). In France, An intervention of a task force took action from March 26th to May 7th, 2020. The task force included nurses and specialists of the county general hospital. There were a total of 770 residents distributed in eight facilities with capacity varying from 53 to 145 residents. The number of deaths peaked at 139 in week 2 and the trough at 0 occurred in weeks 6−7. Comparison between periods (before vs after intervention) showed a significant decrease in the number of new deaths (83/770; 11% vs 35/687; 5%, p = 0.0001) and new COVID-19 cases (348/770; 45% vs 123/422; 29%, p < 0.001)(10). The SAMU 94 and the Faculty of Health of the University of Créteil, France, have jointly implemented an online unit dedicated to nursing homes. Feedback has shown that this geriatric unit is a valuable concept that has been able to improve the management of stress and anxiety in elderly subjects, their families, and staff (11).

We decline any conflict of interest in the establishment of this study.

CONCLUSION

In conclusion, Pre-hospital Emergency Care reduced mortality when patients were treated early with regular control and continued contact with the health system. On the other side, patients consulting later Emergency Departments with developed symptoms of hypoxemia and ARDS had the worst prognosis, required more invasive ventilation, and had higher mortality with multiple organ failure. The development, enforcement, and improvement of pre-hospital care teams are important to achieve better control of COVID-19 disease.

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