Predictors of mortality related to Covid-19

Loubna Aazri *, Salma Ait batahar and Lamyae Amro

Department of pneumology, Arrazi hospital, Mohamed VI hospital, LRMS Laboratory, Faculty of medicine and pharmacy of Marrakech, Morocco.

World Journal of Advanced Research and Reviews, 2022, 13(03), 304–310

Publication history: Received on 06 February 2022; revised on 13 March 2022; accepted on 15 March 2022

Article DOI: https://doi.org/10.30574/wjarr.2022.13.3.0222

Abstract

Introduction: The new 2019 coronavirus has spread rapidly around the world, creating a pandemic. Since the beginning of the pandemic, 6.012.035 patients have died. The objective of this study is to identify clinical and biological parameters associated with high mortality in patients with COVID-19 pneumonia.

Material and methods: We report a retrospective study carried out in a Covid department of the Mohamed VI University Hospital of Marrakech between 20 October and 20 December 2021. Patients were divided into 2 groups: a survivor group and a decedent group.

Results: We collected 103 cases during this period. A male predominance was noted in 55.3% of cases. The group of deceased included 9 cases (8.7%) while the group of survivors contained 94 cases (91.2%). The average age of the patients in the survivor group was 44.6 years, while it was higher in the deceased group (60.6 years). We noted that the deceased patients had more arterial hypertension (55.6% vs. 10.6%) and heart disease (66.7% vs. 0%) than the survivors, and diabetes was more common in the deceased (77.8% vs. 12.8%). Clinical signs were more severe in the decedents. Biological tests showed lymphopenia in 88.9% of the deceased group. Cardiac troponins were also higher in the deceased group with a mean value of 172.7ng/l.

Conclusion: Through our study, we identified four predictors of mortality: age ≥ 65 years, presence of comorbidities, lymphopenia and elevated cardiac troponins.

Keywords: Covid-19; Clinical Aspects; Biology; Predictors of Mortality

1. Introduction

The new coronavirus 2019 or recently renamed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by the World Health Organization (WHO), has spread rapidly around the world [1, 2] achieving a true pandemic, with currently 444.289.762 confirmed cases (5 March 2022).

From the beginning of the pandemic to 05 March 2022, 6.012.035 patients have died around the world [3].

In the present study, we sought to identify clinical and biological parameters associated with high mortality in patients with COVID-19 pneumonia.

* Corresponding author: Loubna Aazri
Department of pneumology, Arrazi hospital, Mohamed VI hospital, LRMS Laboratory, Faculty of medicine and pharmacy of Marrakech, Morocco.

2. Material and methods

This is a retrospective study carried out in a Covid department of the CHU Mohamed VI of Marrakech between 20 October and 20 December 2021. The patients were divided into two groups: a group of survivors and a group of decedents.

All cases of Covid-19 pneumonia confirmed by respiratory PCR were included in the study. For each patient, we analyzed the socio-demographic, clinical and para-clinical characteristics. The data were entered and analyzed using Excel software, version 2010.

3. Results and discussion

3.1. Epidemiological aspects

We collected 103 cases during this period. A male predominance was noted in 55.3% of cases (Figure 1).

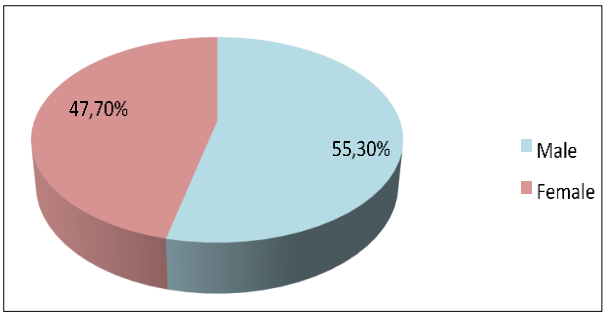

Figure 1 Gender distribution

The group of deceased included 9 cases while the group of survivors contained 94 cases, representing frequencies of 8.7 and 91.2% respectively.

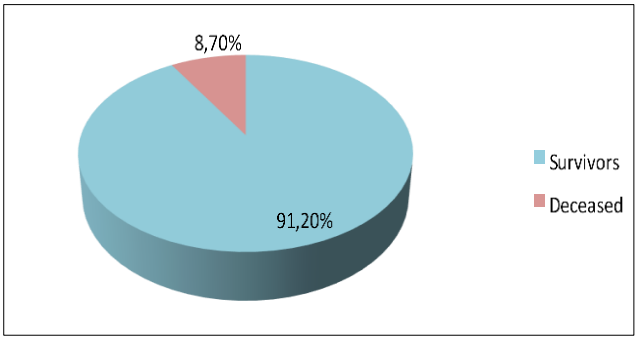

Figure 2 Distribution of death rates

The average age of the patients in the survivor group was 44.6 years, while it was higher in the deceased group (60.6 years) (Figure 3). Furthermore, we found that 56.25% of the patients aged over 65 years are deceased (P value 0, 0000041) (Table 1).

Table 1 Study of the frequency of death in patients aged over 65 years

Age over 65	Death rate	RR	P value	IC
16	56.25%	1.6	0.0000041	1.2- 2.5

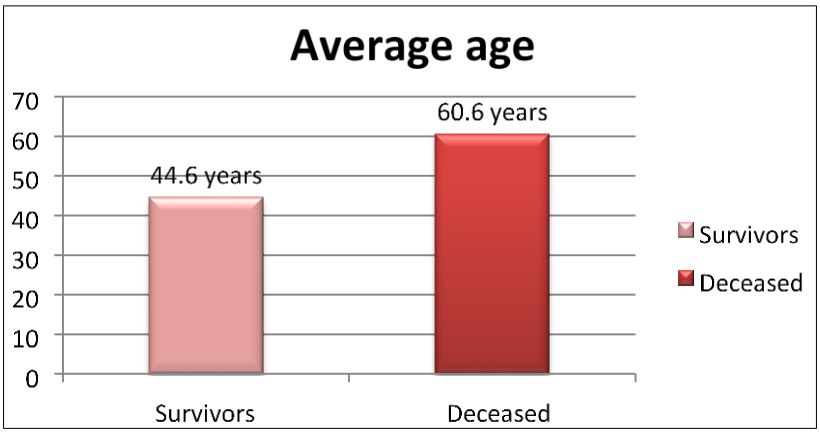

Figure 3 Comparison of the average age of the survivors and the deceased

We noted that the deceased patients had more arterial hypertension (55.6%, P value: 0, 0017) and heart disease (66.7%, p value: 0, 0000015), also diabetes was more frequent in the deceased (77.8%, p value: 0, 00024), while there was no difference in the frequency of other comorbidities between the two groups (asthma, COPD, chronic digestive disorders, tuberculosis, nephropathy) (Table 2).

Table 2 Distribution by background in the survivor and deceased groups

Background	**Survivors**		**Deceased**			
	(n)	**(%)**	**(n)**	**(%)**	**P value**	**RR**
HTA	10	10.6	5	55.6	0.0017	1.4
Diabetes	7	7.2	6	66.7	0.0000015	2.1
Heart disease	0	0	3	33.3	0.00024	-
Tuberculosis	3	3.2	0	0		
Nephropathy	1	1	0	0		
RCH	1	1	0	0		
COPD	1	1	0	0		
Asthma	1	1	0	0		

3.2. Clinical aspects

Symptoms were dominated by cough in 87.4% of cases, fever in 85.4%, dyspnea in 67.9%, myalgia in 58%, and headache in 27.2% and digestive disorders in 11.6% of cases. It should be noted that these symptoms were common to both survivors and decedents, but were more severe in the decedents. Respiratory distress was noted in 88.9% of cases in the group of deceased.

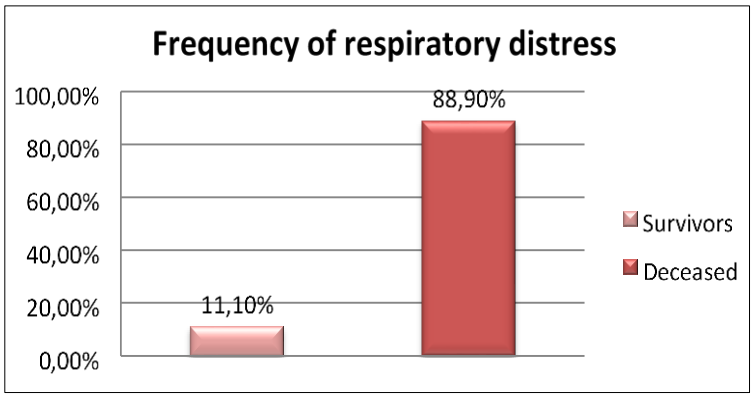

Figure 4 Frequency of respiratory distress in both groups

3.3. Study of para-clinical aspects

3.3.1. Biology

The biological assessment showed:

- A higher frequency of lymphopenia in the deceased group (88.9%, p: 0, 0017) (table 3).
- A higher C-reactive protein (CRP) in the deceased group, with a mean value of 176.5 and extremes ranging from 2.19 to 383 mg/l (table 4).
- Cardiac troponins were also higher in the deceased group with a mean value of 172.7 ng/l and extremes ranging from 4.9 to 863 ng/l (table 4).

Table 3 Abnormalities of the biological assessment in both groups

	Survivors		Deceased			
	(n)	(%)	(n)	(%)	P value	RR
High CRP	28	29.7	9	100	0.00003	1.3
Lymphopenia	29	30.1	8	88.9	0.0006	1.2
Elevated troponins	11	1.7	7	77.8	0.00004	1.5

Table 4 Distribution according to cardiac troponin and CRP levels in the two groups

	Deceased	Survivors
Troponin levels (ng/l)	172.7 (4.9 - 863)	5 (0.03 - 16,9)
CRP level (mg/l)	176.5 (2.19 - 383)	40.9 (0.3 - 200)

The gasometry was pathological in the group of deceased, it showed hypoxia in 7 cases (77.8%) with hypercapnia in 6 cases (66.7%) and acidosis in 3 cases (33.3%).

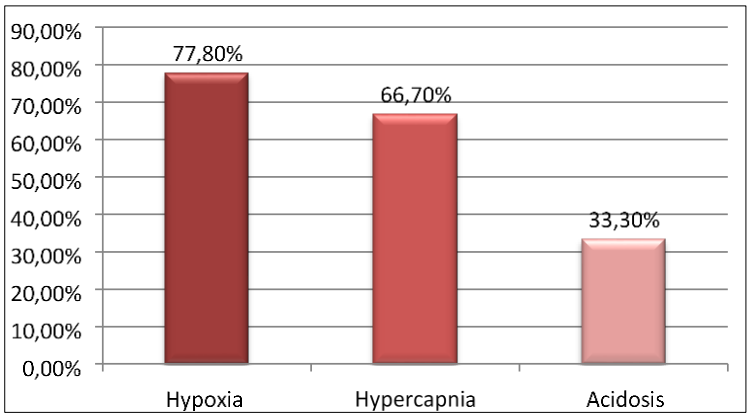

Figure 7 Distribution according to gasometry abnormalities in the deceased group

3.4. Radiology

The chest-CT abnormalities were marked by areas of ground glass in 40% of cases, and an association of ground glass with condensation in 36.6% of cases (Table 5).

Table 5 Distribution according to recorded Chest-CT abnormalities

Chest-CT lesions	Percentage (%)
Ground glass opacity	40
association of ground glass opacity with condensation	36.6
Nodular ground glass	3.33
Normal aspect	16.6

It should be noted that in the group of deceased, the extent of the lesions was greater than 75% in 3 cases (33.3%). In the other group it was always less than 75%.

4. Discussion

Over the years, the corona virus has often been responsible for epidemics around the world. In November 2002, Severe Acute Respiratory Syndrome (SARS) caused by SARS-CoV was first discovered in Guangdong Province, China, and the number of SARS cases increased dramatically over the course of the year and subsequently spread globally [4], infecting 8098 people in 26 countries and killing 774 [5,6,7].

In our study the recorded mortality rate was 8.7%, which is slightly lower than the figures reported in the Rong Hui Du and Chen NS studies in China, which are 11.1% and 11.7% respectively [8,9].

According to the literature, although there are some similarities in clinical features between SARS and MERS (Middle East Respiratory Syndrome Coronavirus), MERS progresses to respiratory failure much more rapidly with much higher mortality than SARS. Older age and underlying comorbidities are likely to be related to the mortality of MERS. [10]

In the present study, 77.8% of the deceased patients were older than 65 years. Furthermore, our analysis revealed that underlying cardiovascular disease as well as diabetes are associated with high mortality in COVID-19 pneumonia cases, which is in line with the results reported in the study by Hong Rui Du et al [8].

In a recent cohort also in China involving 1716 Chinese medical personnel whose age was always < 65 years, only 6 died (0.3%). This means that the majority of patients with COVID-19 pneumonia recover from the disease, especially the younger ones.

As COVID-19 pneumonia is an emerging infectious disease, the mechanisms by which SARS-CoV-2 causes severe disease and fatal consequences in humans are not clearly explained [12]. More recently, it has been reported that CD8+ T cells are significantly decreased in peripheral blood in patients with COVID-19 pneumonia [11]. It has also been shown that the levels of several cytokines and chemokines, such as interleukin-2, interleukin-7, interleukin-10, macrophage colony stimulating factor, monocyte chemoattractant protein, and tumor necrosis factor α (TNF α) were higher in patients with severe COVID-19 pneumonia than in those with mild disease, suggesting that SARS-CoV-2 infection damages the human immune system and results in a systematic inflammatory response [13].

In the study by Hong Rui Du et al. [8], they confirmed that circulating CD3 + and CD8 + T-cell concentrations were significantly reduced in deceased patients compared with the surviving population. More importantly, CD3 + CD8 + T cells ≤ 75 cells/μL were a reliable predictor of mortality in patients with COVID-19 pneumonia.

These data suggest that the occurrence of progressive immune injury and inadequate adaptive immune responses may be possible mechanisms by which SARS-CoV-2 causes severe disease and fatal outcomes.

Also, in the context of biological disturbances, and through the data in the literature, one of the best laboratory parameters reflecting cardiac damage to predict mortality from COVID-19 was cardiac troponin I. Thus, in the management of critically ill patients, the strategy of protecting vital organs should be preferred. For patients with positive cardiac troponin I, what we could do is to choose an appropriate ventilatory support strategy to improve oxygenation and wait for recovery from myocardial damage since the elevation of these troponins is primarily secondary to severe hypoxemia [8].

5. Conclusion

Through our study and after analysis of literature data, we identified four predictors of mortality: age ≥ 65 years, presence of comorbidities (cardiovascular or cerebrovascular diseases, diabetes), lymphopenia (CD3 + CD8 + ≤ 75 cells / μL) and elevated cardiac troponins.

Compliance with ethical standards

Acknowledgments

The author appreciates and acknowledges the support provided by her colleagues in helping with writing this article.

Disclosure of conflict of interest

No conflicts of interest in the subject matter.

References

[1] Wang Chen, Horby Peter W, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. The Lancet. 2020; 395(10223): 470-473.

[2] Le Chang Ying Yan and Lunan Wang. Coronavirus Desease 2019: Coronaviruses and Nlood Safety. Transfus Med Rev. 2020 Apr; 34(2): 75–80.

[3] World Health Organization. Global tuberculosis report 2019. Available from: https://apps.who.int/iris/handle/10665/329368

[4] Zhong NS, Zheng BJ, Li YM, Poon, Xie ZH, Chan KH, Li PH, Tan SY, Chang Q, Xie JP, Liu XQ, Xu J, Li DX, Yuen KY, Peiris, Guan Y. Epidemiology and cause of severe acute respiratory syndrome (SARS) in Guangdong, People's Republic of China, in February, 2003. Lancet. 2003: 362(9393): 1353-1358.

[5] Christian MD, Poutanen SM, Loutfy MR, Muller MP, Low DE. Severe acute respiratory syndrome. Clin Infect Dis. 2004: 38(10): 1420-1427.

[6] Arabi YM, Balkhy HH, Hayden FG, Bouchama A, Luke T, Baillie JK, Al-Omari A, Hajeer AH, Senga M, Denison MR, Nguyen-Van-Tam JS, Shindo N, Bermingham A, Chappell JD, Van Kerkhove MD, Fowler RA. Middle East Respiratory Syndrome. N Engl J Med. 2017: 376(6): 584-594.

[7] Saima Hamid, Mohamed Yaseen Mir and Gilab Khan Rohela. Novel Coronavirus disease (COVID-A9): a pandemic (epidemiology, pathogenesis and potential therapeutics). New Microbes New Infect. 2020 May; 35: 100679.

[8] Rong-Hui Du, Li-Rong Liang, Cheng-Qing Yang, Wen Wang, Tan-Ze Cao, Ming Li, Guang-Yun Guo, Juan Du, Chun-Lan Zheng, Qi Zhu, Ming Hu, Xu-Yan Li, Peng Peng, Huan-Zhong Shi. Predictors of Mortality for Patients with COVID-19 Pneumonia Caused by SARS-CoV-2: A Prospective Cohort Study. Eur Respir J. May 2020; 55(5): 2000524.

[9] Chen NS, Zhou M, Dong X, Qu JM, Gong FY, Han Y, Qiu Y, Wang JL, Liu Y, Wei Y, Xia JA, Yu T, Zhang XX, Zhang L. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020: 395, 507-513.

[10] Hui DS, Memish ZA, Zumla A. Severe acute respiratory syndrome vs. the Middle East respiratory syndrome. Curr Opin Pulm Med. 2014: 20(3): 233-241.

[11] Yingxia Liu, Yang Yang, Cong Zhang, Fengming Huang, Fuxiang Wang, Jing Yuan , Zhaoqin Wan, gJinxiu Li, Jianming Li, Cheng Feng, Zheng Zhang, Lifei Wang, Ling Peng, Li Chen, Yuhao Qin, Dandan ZhaoShuguang Tan, Lu Yin, Jun Xu, Congzhao Zhou, Chengyu Jiang Lei Liu. Clinical and biochemical indexes from 2019-nCoV infected patients linked to viral loads and lung injury. Sci China Life Sci. 2020 Mar;63(3):364-374.

[12] Hong KH, Choi JP, Hong SH, Lee J, Kwon JS, Kim SM, Park SY, Rhee JY, Kim BN, Choi HJ, Shin EC, Pai H, Park SH, Kim SH. Predictors of mortality in Middle East respiratory syndrome (MERS). Thorax 2018: 73(3): 286-289.

[13] Chaolin Huang, Yeming Wang, Xingwang Li, Lili Ren, Jianping Zhao, Yi Hu, Li Zhang, Guohui Fan, Jiuyang Xu, Xiaoying Gu, Zhenshun Cheng, Ting Yu, Jiaan Xia, Yuan Wei, Wenjuan Wu, Xuelei Xie, Wen Yin, Hui Li, Min Liu, Yan Xiao, Hong Gao, Li Guo, Jungang Xie, Guangfa Wang, Rongmeng Jiang, Zhancheng Gao, Qi Jin, Jianwei Wang†, Bin Cao. Clinical features of patients infected with 2019 Novel coronavirus in Wuhan, China. Lancet 2020; 395: 497–506.