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Commentary

Effect of age and comorbidities on mechanical ventilation and outcome among patients' with COVID-19 admitted to Dubai hospital in united arab emirates: A retrospective study

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COVID-19, Comorbidity, Age, Intubation, patient's outcome

Abstract

Introduction: Comorbidities are associated with the severity of COVID-19 and can lead to progress the disease and can cause death. Poor outcomes for COVID-19 have been related to patients with diabetes and hypertensives. In addition, the risk factors related to disease progression and cause death is age. However, this may be a direct result of the comorbidities itself or attributed to other unknown factors along with age.

Purpose: The main goal of the current study is to find the effect of age and comorbidities on patients with COVID-19 intubation and outcome

Methodology: This a single-centered, retrospective study carried out in Dubai hospital, Dubai Health Authority in United Arab Emirates from April 2020 until August 2020. A purposive sampling technique of 660 patients' with COVID-19 met the inclusion criteria were included in this study.

Result: The sample of the study consisted of 660 patients with COVID-19 in Dubai hospital. comorbidity does not affect patient's intubation as p-value= 0.628. On the other hand, Exact fisher test show the there is significant statistically result between comorbidity and patient's outcome p-value= 0.014. In terms of association between Age and patient's with CVOID-19 intubation and outcome. The results were statistically significant on as p-value=0.006 and 0.003 retrospectively. number of death patients who were intubated with HTN and DM was higher 33 (60.0%) compared to patients with HTN 10 (71.4%), and DM 7 (31.8%). Age category was important factor on patient with COVID-19 outcome. Age category was important factor on patient with COVID-19 outcome. Death number among age category (40-49) and who were intubated 28 (51.9%). On the other hand, the lowest death number among intubated patients with COVID-19 were among 20-29 age category.

Conclusion: There are many risk factors associated with greater risk of intubation and even death. The present study found that older age was associated with patients' intubation and death, most likely because of less rigorous immune response. Moreover, Diabetic and hypertension were strong risk factors for invasive ventilatory support among COVID-19 patients and even increase the risk for death.

Recommendation: heath care providers prioritize patients with chronic disease and diagnose them early and monitored closely to improve clinical outcome. Providing this information to clinicians could potentially be used to guide patient care. patients with comorbidities should take all necessary precautions to avoid getting infected with SARS CoV- 2, as they usually have the worst prognosis.

Introduction

WA novel coronavirus was identified in late 2019 as the cause of a cluster of pneumonia cases in Wuhan, China. It has since rapidly spread resulting in a pandemic. The major morbidity and mortality from COVID-19 is largely due to acute viral pneumonitis that evolves to acute respiratory distress syndrome [1]. The coronavirus belongs to a family of viruses that may cause various symptoms such as pneumonia, fever, breathing difficulty, and lung infection. These viruses are common in animals worldwide, but very few cases have been known to affect humans [2]. According to current evidence, COVID-19 virus is primarily transmitted between people through respiratory droplets and contact routes [3]. In an analysis of 75,465 COVID-19 cases in China, airborne transmission was not reported [4].

Droplet transmission occurs when a person is in in close contact within 1 meter with someone who has respiratory symptoms like coughing or sneezing. Therefore, risk of having the mucosae (mouth and nose) or conjunctiva (eyes) exposed to potentially infective respiratory droplets. Transmission may also occur through fomites in the

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immediate environment around the infected person. Therefore, transmission of the COVID-19 virus can occur by direct contact with infected people and indirect contact with surfaces in the immediate environment or with objects used on the infected person like stethoscope or thermometer [5].

The coronavirus COVID-19 is affecting 210 countries and territories around the world (World Meter, 2020). According to world meter website for coronavirus statistics, estimated the total cases worldwide at end of April approximately 2,588,283. In terms of closed cases, 886,436 death and 706,423 recovered cases. Regarding the active cases estimated about 1,701,847. Whereas, 1,644,661 in mild condition and 57,186 in critical condition [6].

Internationally, the vast majority of cases were reported in United State of America (820,273), followed by Spain (208,389), Italy (183,957), France (158,050), Germany (149,044), and 133,495 in United Kingdom [6]. On the nationwide, the first confirmed case of the pandemic of coronavirus disease 2019 (COVID-19) in the United Arab Emirates was announced on 29 January 2020. It was the first country in the Middle East to report a confirmed case. The first patient, a 73-year-old Chinese woman, was released on 9 February after recovering. The first two deaths were confirmed on March 20 [7].

According to Abu Dhabi Healthcare Center report on 22 April, 2020, the total confirmed cases in United Arab Emirates (UAE) are 8,238. Whereas, 6,640 active cases, 1,546 recovered and 52 Death (Abu Dhabi Healthcare Center, 2020).

Comorbidities and age are considered the most important factor for patients' prognosis [8]. Age is a strong risk factor for severe illness, complications, and death. Early U.S. epidemiologic data suggests that the case fatality was highest in persons aged ≥85 years (range 10%-27%), followed by 3%-11% for ages 65-84 years, 1%-3% for ages 55-64 years, and <1% for ages 0-54 years (Centers for Disease Control and Prevention [CDC], 2020) [9].

A descriptive, exploratory analysis report of all cases was generated by Zhonghua in China 2020 [10] as of February 11, 2020. The results have shown that underlying medical conditions had an overall case fatality of 0.9%, but case fatality was higher for patients with comorbidities: 10.5% for those with cardiovascular disease, 7.3% for diabetes, and approximately 6% each for chronic respiratory disease, hypertension, and cancer [10]. On the other hand, handful studies had shown that heart disease, hypertension, prior stroke, diabetes, chronic lung disease, and chronic kidney disease have all been associated with increased illness severity and adverse outcomes [8-12].

Reports suggest that among those infected with severe acute respiratory related to COVID-19, up to 20 percent develop severe disease requiring hospitalization [13]. Although rates vary, among those who are hospitalized, up to one-quarter need intensive care unit (ICU) admission, representing approximately 5 to 8 percent of the total infected population. Differences in the rates of ICU admission may relate to cultural differences in practice and admission criteria for ICU as well as differences in predisposing factors such as age and comorbidities and testing availability in the populations served [14-15].

A single-centered, retrospective, observational study in china shown that rates of ICU admission ranged from 7 to 26 percent [14]. While preliminary reports from Italy suggest that the proportion of ICU admissions were between 5 and 12 percent of the total positive COVID-19 cases, and 16 percent of all hospitalized patients [16]. In an early study of 21 critically ill patients in Washington State, USA, 81 percent of patients with COVID-19 pneumonia were admitted to the ICU and 71 percent were mechanically ventilated [17]. However, this high rate likely reflects the older age of the population which largely came from a nursing home in the region. A larger analysis of 2449 patients reported hospitalization rates of 20 to 31 percent and ICU admission rates of 4.9 to 11.5 percent (Centers for Disease Control and Prevention, 2020).

Significant of the study

This is the first study conducted in Dubai hospital, Dubai Health Authority in United Arab Emirates. This differs from other studies in the field, that UAE is a heterogeneous culture. Moreover, to build up baseline to UAE to compare with other countries worldwide.

Main goals

The main goal of the current study is to find the effect of age and comorbidities on patients with COVID-19 intubation and outcome.

Research questions

1. Is there association between age and patients with COVID-19 intubation?
2. Are there association between comorbidities and patients with COVID-19 intubation?
3. What is the effect of age and comorbidities on patient's outcome (Dead or alive)?

Methodology

This a single-centered, retrospective study carried out in Dubai hospital, Dubai Health Authority in United Arab Emirates from April 2020 until August 2020. A purposive sampling technique of all patients' with COVID-19 met the inclusion criteria were included in this study. All COVID-19 cases reported through January 2020, until August 2020 were extracted from Electronic Medical Records (SALAMA).

Inclusion and Exclusion criteria

All intubated patients with COVID-19 connected to mechanical ventilator and admitted in Dubai hospital were included in this study. Beside stable patients from ward. On the other hand, suspected and cases were excluded.

Data collection procedure

A data collection sheet was created by authors included: patients age, nationality, Comorbidities (pre-exciting condition), date of admission and discharge, date of intubation and extubation reason for doing the test and symptom at diagnosis. Moreover, patients' condition whether dead or alive, and patient's hospitalization (discharge home, ICU, return to unit). All COVID-19 cases reported in Dubai hospital were collected retrospectively from EMR hospital records.

Sample size

Sample size was calculated by PASS software. PASS is a

computer program for estimating sample size or determining the power of a statistical test or confidence interval. NCSS LLC is the company that produces PASS. A sample size of 852 achieves 80.026% power to detect an equivalence difference (d0) of 0.0500 using a one-sided exact test with a significance level (alpha) of 0.0500. These results assume a baseline proportion (PB) of 0.5000 and that the actual difference (d1) is 0.0000. All patients with COVID-19 records who met the inclusion criteria of 660 patients were included in the study.

Planned statistical analysis

Descriptive statistics was used to describe the sample and find the mean and standard deviation. The Exact fisher test used to find association between categorical variables. $p < 0.05$ was defined to be statistically significant. Data was analyzed using Statistical Package for the Social Sciences (SPSS) Version 23.

Table 1: Participants' demographical data.

Variables	Group	Frequency	Percentage
Gender	Male	573	86.8
	Female	87	13.2
Comorbidity	No history	277	42.0%
	HTN	44	6.7%
	DM	99	15.0%
	HTN and DM	240	36.4%
Intubation	Yes	157	23.8
	No	503	76.2
Patients' status	Alive	541	82.0
	Dead	119	18.0
Age	1-10	1	0.2
	11-19	39	5.9
	20-29	150	22.7
	30-39	150	22.7
	40-49	196	29.7
	50-59	158	23.9
	>60	115	17.4

Age	Mean	S. D	Minimum	Maximum	Range
	47.18	12.255	10	92	82

Table 2: Association between comorbidity and patient's intubation* patient's outcome.

Variable	Intubated	Not intubated	P-Value	Variable	Alive	Dead	P-Value
No history	65 (23.5%)	212 (76.5%)	0.628	No history	232 (83.8%)	45 (16.2%)	0.014
HTN	14 (31.8%)	30 (68.2%)		HTN	33 (75.0%)	11 (25.0%)	
DM	22 (22.2%)	77 (77.8%)		DM	90 (90.9%)	9 (9.1%)	
HTN and DM	56 (23.3%)	184 (76.7%)		HTN and DM	186 (77.5%)	54 (22.5%)	

Table 3: Association between Age and patient's intubation* patient's outcome

Variable	Intubated	Not intubated	P-Value	Variable	Alive	Dead	P-Value
11-19	0.0%	1 (100.0%)	.006	11-19	1 (100.0%)	0.0%	0.003
20-29	3 (7.7%)	36 (92.3%)		20-29	38 (97.4%)	1 (2.6%)	
30-39	23 (15.3%)	127 (84.7%)		30-39	127 (84.7%)	23 (15.3%)	
40-49	54 (27.6%)	142 (72.4%)		40-49	161 (82.1%)	35 (17.9%)	
50-59	46 (29.1%)	112 (70.9%)		50-59	132 (83.5%)	26 (16.5%)	
> 60	31 (27.0%)	84 (73.0%)		> 60	81 (70.4%)	34 (29.6%)	

Table 4: Exact fisher results of association between comorbidity and patient's intubation* patient's outcome.

Variable		Group	Patients outcome		P-Value
			Alive	Dead	
No history	Intubation	Yes	28 (42.4%)	38 (57.6%)	0.001
		No	212 (96.8%)	7 (3.2%)	
HTN	Intubation	Yes	4 (28.6%)	10 (71.4%)	0.001
		No	29 (96.7%)	1 (3.3%)	
DM	Intubation	Yes	15 (68.2%)	7 (31.8%)	0.001
		No	88 (90.7%)	9 (9.3%)	
DM and HTN	Intubation	Yes	22 (40.0%)	33 (60.0%)	0.001
		No	158 (88.3%)	21 (11.7%)	

Table 5: Exact fisher results of association Age and patient's intubation* patient's outcome.

Variable		Group	Patients outcome		P-Value
			Alive	Dead	
20-29		Yes	2 (66.7%)	1 (33.3%)	0.077
	Intubation	No	36 (100.0%)	0 (0.0%)	
30-39	Intubation	Yes	9 (39.1%)	14 (60.9%)	0.001
		No	118 (92.9%)	9 (7.1%)	
40-49	Intubation	Yes	26 (48.1%)	28 (51.9%)	0.001
		No	135 (95.1%)	7 (4.9%)	
50-59	Intubation	Yes	27 (58.7%)	19 (41.3%)	0.001
		No	105 (93.8%)	7 (6.3%)	
> 60	Intubation	Yes	5 (16.1%)	26 (83.9%)	0.001
		No	76 (90.5%)	8 (9.5%)	

Ethical consideration

Ethical consideration and compliance were taken up to standard. Formal permission was obtained from Dubai Scientific Research Ethics Committee (DSREC) prior to data collection. Patients' data were anonymous and entered SPSS and Excel program on the author's computer and secured with a username and password.

Results

The sample of the study consisted of 660 patients with COVID-19 in Dubai hospital. The vast majority of patients were male 573 (86.8%). In terms of comorbidity 277 (42%) of patients do not have any previous history. Among admitted patients 157 (23.8%) intubated. 119 (18%) expired. The mean of patients age is 47.18 ± 12.255. The majority of age category were between 40-49 (Table 1).

As Table 2 show that comorbidity does not affect patient's intubation as p-value= 0.628. On the other hand, Exact fisher test show the there is significant statistically result between comorbidity and patient's outcome p-value= 0.014.

In terms of association between Age and patient's with CVOID-19 intubation and outcome. The results were statistically significant on as p-value= 0.006 and 0.003 retrospectively (Table 3).

Table 4 shows number of death patients who were intubated with HTN and DM was higher 33 (60.0%) compared to patients with HTN 10 (71.4%), and DM 7 (31.8%). While, expired intubated patients without comorbidity was 38 (57.6%).

Age category was important factor on patient with COVID-19 outcome. Below Table 5 show that death number among age category (40-49) and who were intubated 28 (51.9%). Followed by patients above 60, then age category 50-59 and finally among 30-39 ages. On the other hand, the lowest death number among intubated patients with COVID-19 were among 20-29 age category.

Discussion

This study considers one of the largest retrospectives of hospitalized patients with COVID-19 in the United Arab Emirates and, to the best of our knowledge, is the first to analyze for comorbidities and age with intubation and patient's outcome in the United Arab Emirates population. Comorbidities are associated with the severity of COVID-19 and can lead to progress the disease and can cause death. Poor outcomes for COVID-19 have been related to patients with diabetes and hypertensives [18]. In addition, the risk factors related to disease progression and cause death is age [19]. However, this may be a direct result of the comorbidities itself or attributed to other unknown factors along with age.

The present study found that age was statistically

significant with patients' intubation and outcome. Similarly, a retrospective study conducted in Wuhan by Wu et al. [20] aimed to describe the clinical characteristics and outcomes in patients with COVID-19. The study consisted of 201 hospitalized patients with confirmed COVID-19 pneumonia. 84 (41.8%) developed ARDS. Patients aged > 65 years associated with a 3.26 increased risk of ARDS (95% CI 2.08-5.11 p<0.001) compared to the under 65s. The study found that Older age was associated with greater risk of development of ARDS and death likely owing to less rigorous immune response [20]. Not only, but also, a study conducted Lian et al. [21] confirmed the same findings, older age patients with COVID-19 had a higher Odd ration for ARDS as 5.37% (35/652) of those aged under 60 developed ARDS, compared to 16.91% (23/136) of 60 and overs (p <0.001). Supporting data in a retrospective study of 420 COVID-19 patients from Shenzen, China (39 ARDS cases) linked between ARDS and older age can be. They found being age 60 or over was associated with a 21.9 increased risk compared to 0-39-year-old [22]. Contrastingly, two smaller studies each with approximately 20 ARDS cases, did not report a significant relationship between age and ARDS. However, they may not have had the sample size or population variation to demonstrate differential risk [23,24]. In the same way, a study conducted by Palaiodimos et al. [25], by using small sample size of 45 ARDS also found no significant relationship of age on both intubation and outcome.

In terms of comorbidity, patients with chronic disease like HTN and DM were also more likely to have increased severity and risk of intubation and might have poor outcome. In our study, the result found that comorbidity does not affect patient's intubation, but it can affect patient's outcome. While a plethora of studies have been conducted to find the effect of comorbidity on disease severity, and a handful of studies have focused on HTN and DM, sparse studies exist on whether this effect patient outcomes. A study found that patients with diabetes at an increased risk of requiring intubation [26]. Another study by conducted by Wu et al. [20], reported a statistically significant relationship between diabetes and ARDS, with Odd Ratio of 2.34 increased risk of ARDS of patients with diabetes. (95% CI, 1.35-4.05, p=0.002). Likewise, findings supported this, with 1.8% (1/56) of non-ARDS having diabetes vs 20.8% (11/53) of ARDS cases (p=0.002) [27]. (Liu et al, 2020). A meta-analysis which found diabetes was associated with relative risk of ARDS of 4.64 (95% CI 1.86, 11.58, p = 0.001) [28]. Further support for this relationship comes from Shi 2020b, which found ARDS was more common in diabetic patients (ARDS rates: non-diabetics 17/153 11.1% vs diabetics 38/153 24.8% p=0.002 [29]. In a cohort study of 7337 patients with COVID-19 with and without diabetes It was shown that those with poorer blood glucose control had an all-around increased mortality rate than those with glucose control [30].

The present study found that hypertension was associated with an increased risk of intubation and death. Similarly, a study found that hypertension was associated with ratio found that of 1.82 for developing ARDS (95% CI, 1.13-2.95, p=0.01) compared to patients without hypertension [20]. Same as result found by Zhang et al. [30], which found hypertension carried an adjusted hazard ratio of ARDS of 1.61 (1.32,1.97; p=0.000). Conversely, findings of three studies found that no significant increased risk of ARDS associated with hypertension [26,25]. A previous study showed that older patients and those with co-morbid conditions (cardiovascular disease, chronic respiratory disease, hypertension and diabetes) have higher mortality risk due to COVID-19, particularly after intubation and mechanical ventilation [31]. Old age, hypertension, and several presenting symptoms were strong risk factors for invasive ventilatory support among COVID-19 patients. They must be diagnosed early and monitored closely to improve clinical outcome. Systematic review and meta-analysis done by Jing Yang et al. [32] showed that the pool odds of hypertension in severe patients compared to non-severe patients was 2.36 (95% CI: 1.46-3.83). A study shows that COVID-19 patients with underlying hypertension contributed for high percentage of ICU admission with invasive mechanical ventilator support. Patients with underlying hypertension also had 3.9 times the odds of being intubated with mechanical ventilatory support after adjusting for age, other comorbidities and clinical presentations. Hypertension was the most common NCD that predicted poor prognosis in patients with COVID-19 [33].

Conclusion

Recently, number of infected cases with COVID-19 increased dramatically that lead to increase in-hospital admission and seek for urgent medical treatment and in some cases, intubation is required. There are many risk factors associated with greater risk of intubation and even death. The present study found that older age was associated with patients' intubation and death, most likely because of less rigorous immune response. Moreover, Diabetic and hypertension were strong risk factors for invasive ventilatory support among COVID-19 patients and even increase the risk for death. Therefore, heath care providers prioritize patients with chronic disease and diagnose them early and monitored closely to improve clinical outcome. Providing this information to clinicians could potentially be used to guide patient care.

Recommendation

Therefore, patients with comorbidities should take all necessary precautions to avoid getting infected with SARS CoV- 2, as they usually have the worst prognosis. These precautions include regular handwashing with soap and water or use of alcohol-based hand sanitizer, limiting person-to-person contact and practicing social distancing, wearing a face mask in public places, and overall limiting going to public areas at this time unless it is necessary. Hence, there is a need for a global public health campaign to raise awareness, on reducing the burden of these comorbidity illnesses causing deaths in COVID-19-infected patients.

References

1. https://www.uptodate.com/contents/coronavirus-disease-2019-covid-19-critical-care-issues
2. Adhikari SP, Meng S, Wu YJ, et al. Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: A scoping review. Infect Dis Poverty. 2020; 9:29.
3. Liu J, Liao X, Qian S, et al. Community transmission of severe acute respiratory syndrome coronavirus 2, Shenzhen, China, 2020. Emerg Infect Dis. 2020; 26: 1320-1323.

4. van Doremalen N, Morris D, Bushmaker T, et al. Aerosol and Surface Stability of SARS-CoV-2 as compared with SARS-CoV-1. New Engl J Med. 2020. 382: 1564-1567.
5. https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations
6. https://www.worldometers.info/coronavirus/#countries
7. Natasha T. First Middle East cases of coronavirus confirmed in the UAE CNBC.com. Retrieved 19 March 2020.
8. Guan WJ, Ni ZY, Hu Y, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl J Med. 2020; 382: 1708-1720.
9. CDC COVID-19 Response Team. Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19) — United States, 2020. MMWR Morbidity and mortality weekly report.
10. Novel Coronavirus Pneumonia Emergency Response Epidemiology T. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China. Zhonghua Liu Xing Bing Xue Za Zhi. 2020; 41: 145-151.
11. Wang D, Hu B, Hu C, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA. 2020; 323: 1061-1069.
12. Yang X, Yu Y, Xu J, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. Lancet Respirat Medi. 2020.
13. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020; 395: 497.
14. Yang X, Yu Y, Xu J, at al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. Lancet. 2020.
15. Chen T, Wu D, Chen H, et al. Clinical characteristics of 113 deceased patients with coronavirus disease 2019: retrospective study. BMJ. 2020; 368: m1091.
16. Grasselli G, Pesenti A, Cecconi M. Critical Care Utilization for the COVID-19 Outbreak in Lombardy, Italy: Early Experience and Forecast During an Emergency Response. JAMA. 2020. 323: 1545-1546.
17. Arentz M, Yim E, Klaff L, et al. Characteristics and Outcomes of 21 Critically Ill Patients With COVID-19 in Washington State. JAMA. 2020; 323: 1612-1614.
18. W-Jie G, Liang WH, He JX, et al. Cardiovascular comorbidity and its impact on patients with COVID-19. Eur Respir J. 2020; 55: 2001227.
19. Schell-Chaple HM, Puntillo KA, Matthay MA, et al. Body temperature and mortality in patients with acute respiratory distress syndrome. Am J Crit Care. 24: 15-23.
20. Liu Y, Sun W, Li J, et al. Clinical features and progression of acute respiratory distress syndrome in coronavirus disease 2019. medRxiv. 2020.
21. Huang I, Lim MA, Pranata R. Diabetes mellitus is associated with increased mortality and severity of disease in COVID-19 pneumonia – A systematic review, meta-analysis, and meta-regression. Diabetes Metab Syndr. 2020; 14: 395-403.
22. Wu C, Chen X, Cai Y, et al. Risk Factors Associated with Acute Respiratory Distress Syndrome and Death in Patients With Coronavirus Disease 2019 Pneumonia in Wuhan, China. JAMA. 2020; 180: 934-943.
23. Lian J, Jin X, Hao S, et al. Analysis of Epidemiological and Clinical Features in Older Patients With Coronavirus Disease 2019 (COVID-19) Outside Wuhan. Clin Infect Dis. 2020: ciaa242.
24. Bi Q, Hong C, Meng J, et al. Characterizing clinical progression of COVID-19 among patients in Shenzhen, China: an observational cohort study. medRxiv. 2020.
25. Dreher M, Kersten A, Bickenbach J, et al. (2020) The Characteristics of 50 Hospitalized COVID-19 Patients With and Without ARDS (17.04.2020). Dtsch Ärztebl Int. 2020; 117: 271-278.
26. Rica R de la, Borges M, Aranda M, et al. Low albumin levels are associated with poorer outcomes in a case series of COVID-19 patients in Spain: a retrospective cohort study. medRxiv. 2020.
27. Palaiodimos L, Kokkinidis DG, Li W, et al. Severe obesity is associated with higher in-hospital mortality in a cohort of patients with COVID-19 in the Bronx, New York. medRxiv. 2020.
28. http://www.diabetesincontrol.com/diabetes-and-intubation-in-covid-19/
29. https://www.cebm.net/covid-19/are-there-risk-factors-and-preventative-interventions-for-acute-respiratory-distress-syndrome-ards-in-covid-19/
30. Zhu L, She ZG, Cheng X, et al. Association of Blood Glucose Control and Outcomes in Patients with COVID-19 and Pre-existing Type 2 Diabetes. Cell Metabolism. 2020; 31: 1068-1077. e3.
31. Ruan Q, Yang K, Wang W, et al. Clinical predictors of mortality due to COVID 19 based on an analysis of data of 150 patients from Wuhan, China. Intensive Care Med. 2020; 46: 846-848.
32. Yang J, Zheng Y, Gou X, et al. Prevalence of comorbidities in the novel Wuhan coronavirus (COVID-19) infection: a systematic review and meta-analysis. Int J Infect Dis. 2020; 94: 91-95.
33. Hasani WSRH, Ganapathy SS, Lin CZ, et al. Comorbidities and clinical features related to Invasive Ventilatory Support among COVID-19 cases in Selangor, Malaysia. Zenodo. 2020.