Original Research Article

Charlson Comorbidity Index Score and its impact on severe outcome and death in COVID-19 cases: A retrospective analysis

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Received: 15-06-2021 / Revised: 12-08-2021 / Accepted: 27-09-2021

Abstract

Background and aims: The COVID-19 disease disproportionately affects patients with various comorbidities. Hence, thorough comorbidities evaluation can help establish risk stratification and triaging of patients with COVID-19, upon hospital admission. Charlson Comorbidity Index (CCI) is a validated, simple, and readily appropriate method of assessing the risk of severe outcomes and death from comorbid diseases and has been widely used as a predictor of long-term prognosis and survival. **Methods:** We performed a retrospective analysis of the data obtained from Electronic Medical record of all the patients admitted to our hospital with positive COVID-19 RT PCR report between October and November 2020 using XLSTAT software. **Results:** Compared to a CCI score of 0, a CCI score of 1-2,3-4 and a CCI score of ≥4 were found to be associated with mortality and composite of the severe outcome. **Conclusion:** CCI score can be useful and maybe employed for risk assessment of hospitalized COVID-19 patients.

Keywords: Charlson comorbidity index, COVID-19, Mortality, Severity.

Introduction

The outbreak of emerging severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) disease (COVID-19) in China has been brought to global attention and declared a pandemic by the World Health Organization (WHO) on March 11, 2020.[1] The first case of COVID-19 in India was reported from Kerala on 2th of January 2019.[2] As of 10 March 2021, there have been 11,262,707 confirmed cases of COVID-19 with 158,063 deaths, reported to WHO from India.[3] Many studies have been done which have explored and compared the epidemiologic, demographic, clinical, laboratory, and radiological characteristics as well as the complications, treatment, and outcomes of hospitalized patients with non severe and severe COVID-19.[4–7] The impact of various comorbidities in predicting the mortality and severe outcome and to use a scoring system for the same has been the major research domain in the past few months so that the second wave of a pandemic can be managed in a better way.[6–16] Charlson comorbidity index was developed in 1987 and has been used in several studies to predict mortality because of the impact of comorbidities. [17] Since COVID-19 pneumonia severity is affected by age and comorbidity we hypothesized that this index basic scoring method can help to predict mortality in COVID-19 infected hospitalized patients.

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Materials and methods

Search and selection criteria: This is a retrospective non-interventional single-center case-control study in which we enrolled all patients who were admitted to our hospital between the 1st of October 2020 till 30th of November 2020.

Inclusion criteria: all patients admitted with COVID-19 RT PCR positive report above 18 years of age.

Exclusion criteria: patients below 18 years of age or COVID-19 negative

731 patients were admitted to the hospital during this period with a COVID-19 positive RT PCR report. All patients underwent basic routine investigations, HRCT thorax, and biomarker levels like D dimer procalcitonin, LDH, Ferritin, and CRP on admission. All clinical data were collected retrospectively in the standard clinical research form. This retrospective analytical study was approved by the internal ethics committee (IEC) and as there was no active involvement of human subjects in the study a consent waiver was also given by the IEC. History of various associated comorbidities was taken, and Charlson's comorbidity index score (CCIS) was calculated for all patients. All patients were categorised into four categories depending upon their CCIS: CCIS 0, CCIS 1-2, CCIS 3-4, CCIS>4, and baseline characteristics were compared.

The data was prepared and internally evaluated by which we could find outliers in the continuous series so median with IQR was calculated for descriptive statistics.

The outcome of interest was a composite of death, ICU stays, and mechanical ventilatory support. The percentage of death and outcome was calculated in these four groups separately.

Results

A total of 731 patients were detected with COVID-19 of which 117 (16%), 274(39.6%) ,290(39.6 %) and 50(6.8%) had a CCIS of 0,1-2,3-4 and >4, respectively. (Table 1) The median age of the total population was 60 years, with the oldest patients in CCIS>4 (median of 78.5 years).

Table 1: Categorisation of patients according to Charlson's Comorbidity Index Score

	CCIS 0 (n=117)	CCIS 1-2 (n=274)	CCIS 3-4 (n=290)	CCIS >4 (n=50)	TOTAL (n=731)
Male	88	183	220	37	528
Female	29	91	70	13	
Age [IQR]	38 [32, 43]	56 [50, 60]	68 [63, 74]	78.5 [71.25, 82.75]	60 [50, 69]
CCIS [IQR]	0 [0, 0]	2 [1, 2]	3 [3, 4]	5 [5, 6]	2 [1,3]
Co-morbidities, no. (%)					
DM	0 (0)	106 (38.68)	181 (62.41)	44 (88)	331 (45.28)
MALIGNANCY	0 (0)	0 (0)	6 (2.06)	1 (2)	7 (0.95)
CAD	0 (0)	3 (1)	35 (12.06)	20 (40)	58 (7.93)
CKD	0 (0)	6 (2.19)	17 (5.86)	15 (30)	38 (5.19)
CLD	0 (0)	1 (0.36)	2 (0.68)	0	3 (0.41)
ILD/BA/COPD/TB	0 (0)	4 (1.45)	13 (4.48)	3 (6)	20 (2.73)
OBESITY	0 (0)	0 (0)	1 (0.3)	1 (2)	2 (0.27)
NEUROLOGICAL	0 (0)	3 (1.09)	10 (3.44)	4 (8)	17 (2.32)
HTN	0 (0)	96 (35.04)	152 (52.41)	33 (66)	281 (38.44)
POST-TRANSPLANT	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Table 2: Severe Outcome and Deaths amongst different CCIS score patients

	CCIS 0 (n=117)	CCIS 1-2 (n=274)	CCIS 3-4 (n=290)	CCIS >4 (n=50)	TOTAL (n=731)
Severe Outcome n (%)	14 (11.97)	67 (24.45)	103 (35.52)	20 (40)	204 (27.91)
Deaths n (%)	1 (0.85)	21 (7.66)	37 (12.76)	7 (14)	66 (9.03)

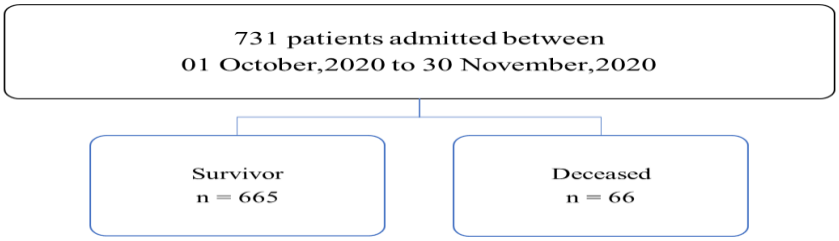

Fig. 1: Demographic Data

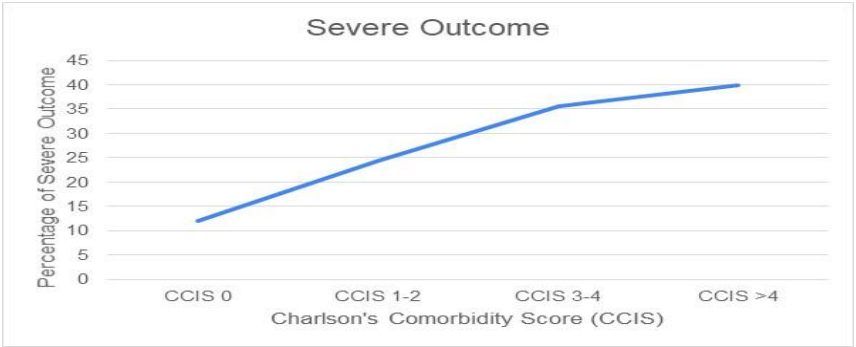

Fig. 2: Percentage of Severe outcome across different categories of CCIS

Fig. 3: Percentage of death across different categories of CCIS

Diabetes was the most common associated comorbidity (n=331,45.28%) followed by hypertension (n=281,38.44%). Other comorbidities which were recorded as coronary artery disease (n=58,7.93%), Chronic Kidney disease (n=38, 5.19%), chronic lung disease e.g. ILD,COPD, Asthma (n=20,2.73%) Malignancy, Post-Transplant status and Neurological disorders**.(Table-1)** Overall, 204 patients (27.91 %) had severe outcomes and 66 (9.03%)died. In the CCIS 0 group, 14 (11.97%) had severe outcomes and 1(0.85%) died. In the CCIS 1-2, 3-4 and >4 groups, 67 (24.45%), 103(35.52%), 20(40%) had severe outcomes and 21(7.66 %), 37(12.76%),7 (14%) died, respectively.

The odds of severe COVID-19 were significantly increased in CCIS 1-2(Odds ratio [OR], [9.62 (95% CI 1.81 - 51.13]), CCIS 3-4 (OR 16.96 (95% CI, 3.27 - 88.04) and CCIS >4 (OR 18.88 (95% CI, 3.16 - 112.8) as compared to those for CCIS 0.

Discussion

The Charlson Comorbidity Index was first developed in 1987 by Mary Charlson and colleagues as a weighted index to predict the risk of death within 1 year of hospitalization for patients with specific comorbid conditions. [17]Previous studies identified the subsequent single comorbidities as risk factors for poor COVID-19 outcomes: congestive heart failure, coronary heart disease, cardiac arrhythmia, cancer, chronic obstructive pulmonary disease, and diabetes. [18,19] These comorbidities were also recorded in our study and found to associate with adverse outcomes. A Charlson Comorbidity Index Score above 0 was associated with an increased risk of severe COVID-19 and death in this Danish study published by Christensen et al in September 2020. [20] This study expanded upon the previous findings of individual comorbidities as independent risk factors for poor COVID-19 outcomes. Recently a metanalysis was published by Tuty Kuswardhani RA et al suggested that Compared to a CCI score of 0, a CCI score of 1-2 and a CCI score of ≥3 were prognostically associated with mortality and associated with a composite of poor outcomes. [21] They also showed that a Per point increase of CCI score increased mortality risk by 16%. A higher mean CCI score also had a significant association with mortality and disease severity.

We also find similar results and correlations in our study. Yelda Verol et al proposed a novel scoring model -CoLACD (COVID-19-19 Lymphocyte ratio, Age, CCI score, Dyspnea) mortality score which scores from 0 to 5 points. The cut-off value of this scoring system, which determines the mortality risk in patients, was 2.5 points with 82% sensitivity and 73% specificity (AUC = 0.802, 95% CI 0.777-0.886, P < .001).[22]This study showed that by using the CoLACD mortality score, clinicians may achieve a prediction of mortality in COVID-19-19 patients hospitalised for pneumonia.[22]In this Korean study diabetes, hypertension, chronic lower respiratory disease, chronic renal failure, and end-stage renal disease were associated with severe COVID-19.[23]

The findings in our study were like the findings in the similar study done by Christensen DM et al showing a higher odd of dying in in the CCIS 1-2,3-4, AND >4 groups as compared to the CCIS 0 group. [20]

Limitations: This is a retrospective single Centre study and was done retrospectively, hence more prospective studies are needed for validation. Also, a single-time clinical evaluation at admission may not correctly reflect the course of the disease. One may also think that comorbidities may be more in the older age group and age alone can affect mortality.

Conclusion

Higher Charlson's Comorbidity score is associated with an increased risk of poor prognosis and bad outcome and death. Some more studies are required to assess the effect of comorbidity combinations on COVID-19 outcomes and to determine if other validated comorbidity scores can predict depraved outcomes of COVID-19.

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Source of Support: Nil
Conflict of Interest: Nil

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