Research Article

Comorbidity and Mortality Rate Analysis in Geriatric Population Using Charlson Comorbidity Index

Susan K. Thottam*, Theresa Alphonsa Jose, Mohammed Firdous K.P, Sona Jose, Veeresh Babu D
Department of Pharmacy practice, Shree Devi College of Pharmacy, Mangaluru, Karnataka, India.
***Corresponding author's E-mail:** susanthottam@gmail.com

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ABSTRACT

Majority of the Indian population is elderly, but we have limited studies conducted on geriatric population. They are often presented with comorbid conditions. Mortality rate of geriatric patients can be considered as an evaluating factor of Indian medical science. Different parameters can be used to predict the mortality rate. This study has used the Charlson Comorbidity Index to predict the mortality rate in geriatric population and has checked its validity in geriatric south Indian population. Study was conducted on a total of 220 geriatric populations with comorbid condition. Maximum of nine comorbid condition was seen in a single patient. More patients were presented with four number of comorbidity (29%) followed by two number of comorbidities (25%). Out of 220 patients 44 (20%) deaths were reported within six months. The Charlson Comorbidity Index is a well- validated research methodology to assess one year mortality, but Kaplan Meier plot in this study exhibits a slight variation from the index. However, cumulative survival of high index population was with accordance with Charlson comorbidity index. The study also revealed that it is statistically significant to divide population according to Charlson comorbidity index.

Keywords: Geriatric, Comorbidity, Mortality rate, Charlson Comorbidity Index, Kaplan Meier.

INTRODUCTION

India's geriatric population is sizeable than the total population of many developed and developing nations. But despite this the branch of medicine for geriatrics is very new in India and not in sufficient numbers and with little knowledge as there are no sufficient number of studies carried out among geriatric populations. 2011 World Health Statistics report says 7% of total population is elderly, i.e. 83 million persons in India are 60 years and above. Studies say that in coming four decades there may be dramatic shift of Indian population from young to an aging population. [1, 2, 3]

Geriatric population indicates a successful growth of medical science. Life expectancy also reflects social, economic and wellbeing of the population. Chronic medical conditions are considered to be the leading cause of death among geriatric population both in rural and urban region. Aging results in various physiologic changes making them more susceptible for various medical chronic conditions and drug induced issues leading to increased mortality rate. [1, 4-8]

Different studies conducted in various parts of the world has taken various parameters like BMI, life style, nutritional status etc., to check their association with mortality rate in geriatric patients.[7, 9] This study had used comorbid condition and patients age for predicting the mortality rate, with the help of Charlson comorbidity index. Charlson et al, has developed Charlson Comorbidity Index, which scores comorbid conditions and age of the patient and hence determine a one year mortality rate in patients. This Index was later validated in Breast cancer patients.[10, 11] The Kaplan – Meier plot had been used which is the simplest way of analyzing the survival over time.[12, 13]

AIM

- To evaluate the prevalence of comorbidities in geriatric population.
- To predict the mortality rate of geriatric population using Charlson Comorbidity Index.
- To analyse the reliability of Charlson Comorbidity Index for assessing mortality rate in geriatric patients.

MATERIALS AND METHODS

Study Design and Duration

A prospective observational study was carried out for a period of 6 months (from December 2017 to June 2018). The prevalence of comorbid condition and the ability of Charlson Comorbidity to assess mortality rate among geriatric population was analysed.

Study Site and Study Population

Study was carried out on geriatric inpatients in the department of General Medicine at Yenepoya Medical College hospital, Mangaluru. The proposed study was approved by Institutional Ethics Committee (ICE) of the same institution.

Patients of 65 years and above with multimorbid condition, who were willing to participate were included in the study.

Sample Size

It was calculated using the G-POWER software with level of significance α=5%, power β=80%, with 95% confidence interval. The minimum sample size required for the study was 220.

Study Protocol and Data Analysis

A patient information sheet was given to the patients in their native language and informed consent was obtained from the patient and/or care givers. Patients above 65 years of age with comorbid condition were selected for the study. Data was collected through review of case sheets of the study population admitted in department of General Medicine. The data collected included patient demographics and comorbid conditions. Charlson score was calculated for each patients by adding the individual score assigned to each disease diagnosed in the patients and for the age group. The resulted Charlson comorbidity index was used to divide the population and to predict the mortality for a patient who may have a range of comorbid conditions. The patients were followed for a period of 6 months to obtain their health status. Death reports were collected from Medical Record Department (MRD) or else through telephone interactions. The patients were presumed to be alive if deaths were not confirmed. Both confirmed alive and presumed alive were classified as alive for the purpose of analysis. The data was recorded in Microsoft Excel worksheet and analysed by using statistical package for social science (SPSS software).

RESULTS

Out of 220 geriatric patients admitted in the hospital during study period, 139 (63%) were males and 81 (36%) were females. The patients were divided into 3 groups on the basis of their age as young old (65-74 years), middle old (75-84 years) and old old (≥ 85 years). Mean age of patients was 70.72 ± 5.42 years. Age distribution revealed that 174 (79%) of patients were young old, followed by 39 (17%) in middle old and 7 (3%) in old old group. Mean age of young old, middle old and old old were found to be 67.73 ± 2.79, 77.85 ± 2.16 and 86 ± 1.82 respectively. The maximum age was found to be 90 years.

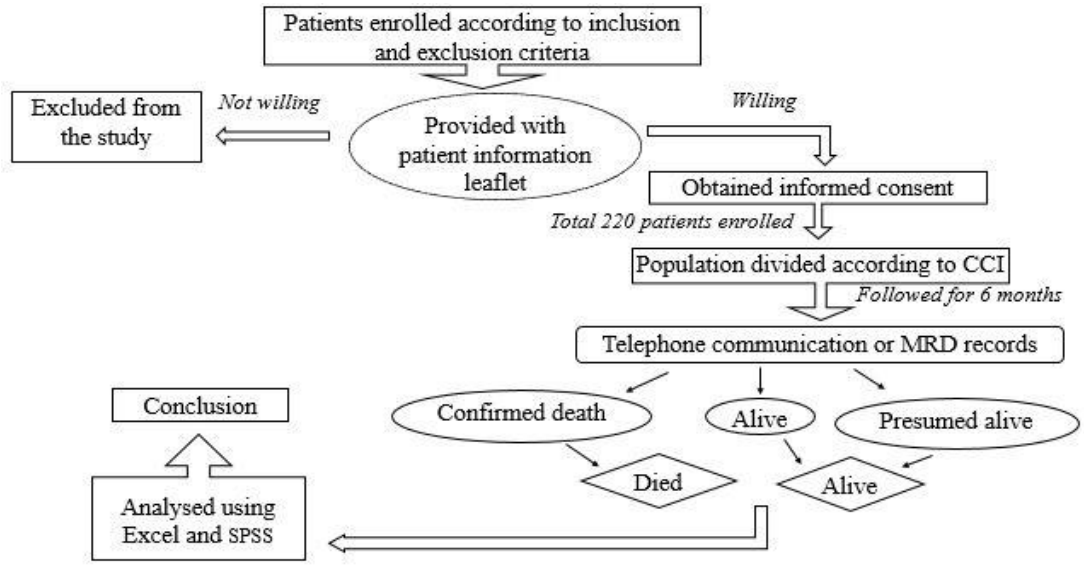

Figure 1: Flow chart for methodology. (*CCI –Charlson Comorbidity Index, MRD – Medical Records Department)*

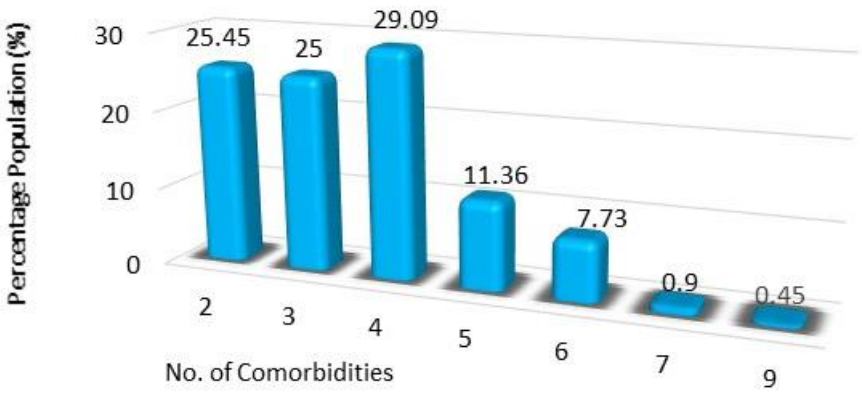

Figure 2: Frequency distribution of number of comorbidities

Table 1: Age group and no. of comorbidities cross tabulation. (*Y- young old, M – middle old, O –old old)*

			No. of Comorbidities							Total
			2	3	4	5	6	7	9	
Age group	Y	Count	43	43	49	23	13	2	1	174
		% within Age group	24.7	24.7	28.2	13.2	7.5	1.1	0.6	100 %
		% within No. of Comorbidities	76.8	78.2	76.6	92.0	76.5	100	100	79.1 %
	M	Count	9	11	14	1	4	0	0	39
		% within Age group	23.1	28.2	35.9	2.6	10.3	0.0	0.0	100 %
		% within No. of Comorbidities	16.1	20.0	21.9	4.0	23.5	0.0	0.0	17.7%
	O	Count	4	1	1	1	0	0	0	7
		% within Age group	57.1	14.3	14.3	14.3	0.0	0.0	0.0	100 %
		% within No. of Comorbidities	7.1%	1.8%	1.6%	4.0%	0.0%	0.0%	0.0%	3.2%
Total		Count	56	55	64	25	17	2	1	220
		% within Age group	25.5	25.0	29.1	11.4	7.7	0.9	0.5	100 %
		% within No. of Comorbidities	100.0	100	100	100	100	100	100	100%

Patients with minimum 2 diagnosis were enrolled into the study and maximum number of diagnosis seen was 9. Maximum patients (29%) were presented with 4 diagnosis followed by patients with 2 diagnosis (25%).[Figure: 2] Maximum number of patients belonged to male young old group with two comorbid conditions and among females frequency of young old with three comorbid conditions was more. There is no association between age groups and no. of comorbidities as Chi-Square Test P value was not statistically significant (P value = 0.661> 0.05). [Table: 1]

Table 2: Gender and No. of comorbidities cross tabulation *(F - female, M - male)*

		No. of Comorbidities							Total
		2	3	4	5	6	7	9	
Gender	F Count	13	21	31	7	7	1	1	81
	% within Gender	16.0	25.9	38.3	8.6	8.6	1.2	1.2	100%
	% within No. of omorbidities	23.2	38.2	48.4	28.0	41.2	50.0	100	36.8%
	M Count	43	34	33	18	10	1	0	139
	% within Gender	30.9	24.5	23.7	12.9	7.2	0.7	0.0	100 %
	% within No. Of Comorbidities	76.8	61.8	51.6	72.0	58.8	50.0	0.0	63.2%
Total	Count	56	55	64	25	17	2	1	220
	% within Gender	25.5	25.0	29.1	11.4	7.7	0.9	0.5	100 %
	% within No. of Comorbidities	100	100	100	100	100	100	100	100 %

There is no association between gender and no. of comorbidities as Chi-Square Test-P value is not statistically significant. (P value = 0.087 > 0.05) [Table: 2]

Among 220 patients, majority of them were diagnosed with hypertension (70%), followed by diabetes mellitus (DM) (53%), COPD (34%), and ischemic heart disease (IHD) (30%). [Table 3] Sample population was divided on the basis of Charlson Comorbidity Index into low (n = 6) moderate (n =78) and high (n = 136). Total 44 deaths were reported. Maximum deaths were reported from group high (34) followed by group moderate (9) and from group low 1 (Figure:3). There is a statistically significant difference of mortality rate between three groups ($P < 0.05$) which confirms that the survival distributions of the different indexed groups are not equal in the study population (i.e., they are not all the same). [Figure 3 & Table 4]

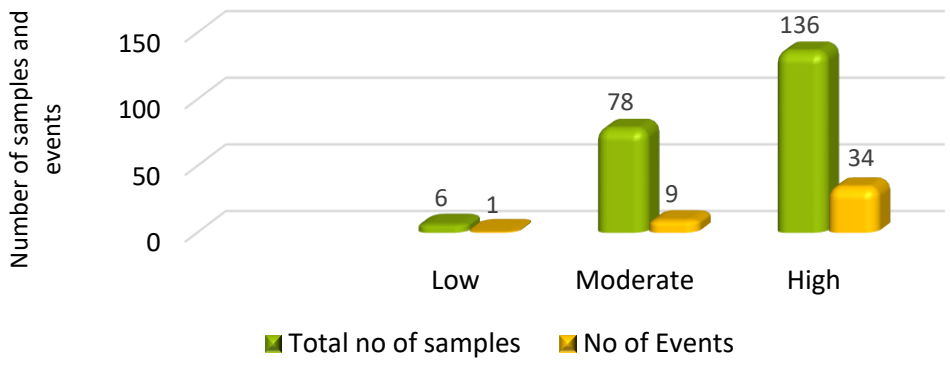

Figure 3: Charlson Comorbidity Index and mortality relationship *(No. of events = No of deaths)*

Table 3: Major diagnosis

Major Diagnosis	No. of Patients	Percentage (%)
Hypertension	154	70
Diabetes mellitus	117	53.18
COPD	76	34.54
Ischemic heart disease	68	30.90
Renal failure	52	23.64
LRTI	23	10.45
Cerebral vascular accident	21	9.55
Anaemia	20	9.09
Benign prostate hypertrophy	19	8.64
Urinary tract infection	16	7.27
Pulmonary tuberculosis	12	5.45
Osteoarthritis	12	5.45
Cancer	9	4.09
Rheumatoid arthritis	8	3.63
CLD	7	3.18
Thyroid disorder	7	3.18
Sepsis	6	2.72
Gastritis	5	2.27
Seizure	5	2.27
Lumbar spondylitis	5	2.27
GERD	4	1.81
Parkinsonism	4	1.81
Myocardial infarction	4	1.81
Dementia	3	1.36
Psychotic conditions	2	0.9

Table 4: Means for survival time *(a. Estimation is limited to the largest survival time if it is censored.)*

Index	Mean[a]			
	Estimate	Std. Error	Lower Bound	Upper Bound
low	5.833	.152	5.535	6.132
Middle	5.949	.033	5.885	6.013
High	5.324	.117	5.094	5.553
Overall	5.559	.076	5.410	5.708

Cumulative survival proportion appears to be little higher in the middle group compared to the low index groups. Survival distribution of the different types of index are not equal in the study population. However, if we inspect the curve's last cumulative survival proportion, we can see that the proportion of participants that had not died by the end of the study does not appear that different between the intervention groups. [Figure: 4 and Table: 4]

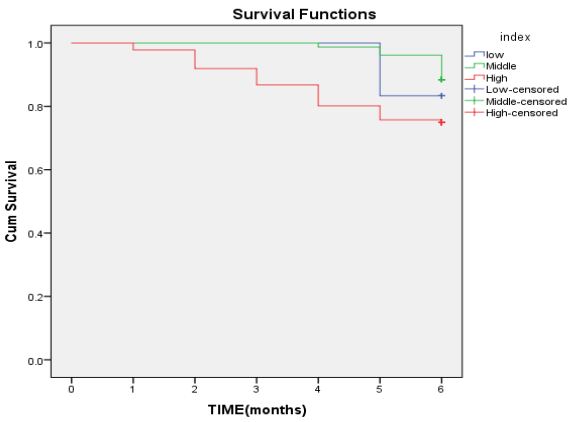

Figure 4: Kaplan-Meier plot

DISCUSSION

Demographic characteristics showed a male predominance (63.18%) and female patients contributes only 36.82%. Similar male predominance was seen in studies conducted by Chitra B et al[14], Ahluwalia C S et al[15] and Salwe J K et al[16]. We divided the patients into 3 groups on the basis of their age as young old (65-74 years), middle old (75-84 years) and old old (≥ 85 years). Mean age of patients was 70.72 ± 5.42 years. Majority of the patients falls in young old age group (79%) followed by middle old (17%) and old old age group (3%). Male young old predominance was observed in this study. Chitra B et al[14] and Salwe J K et al[16] had a similar age distribution of our study, whereas in Ahluwalia C S et al[15], a middle old prevalence of geriatric patients was observed.

A large number of patients (29%, n=64) were presented with 4 comorbid conditions, followed by 2 comorbid conditions (25.45%, n =56) and 3 comorbid conditions (25%, n =55). Similar results were shown by studies conducted by Ahluwalia C S et al[15] and Rakesh B K et al[17]. The study conducted by Raut A et al[4] concluded a predominance of 2 comorbid conditions. Nine and more comorbidities were rarely reported in all studies. Chi-Square test revealed that there is no association with age group and gender with number of comorbidities.

The elderly population suffers from numerous chronic disorders. In this study, major diagnosis observed were hypertension, diabetes mellitus, COPD, ischemic heart disease, renal failure, LRTI, cerebral vascular accident, anaemia, benign prostrate hypertrophy, urinary tract infection, pulmonary tuberculosis, osteoarthritis, cancer etc. Hypertension was most commonly observed among the study population. Major diagnosis was compared with other studies conducted by Chitra B et al[14], Raut A et al[4] and Rakesh B et al[17] which revealed that hypertension and diabetes mellitus was more prevalent in geriatric population.

On the basis of Charlson comorbidity index, we divided the sample population into low (6), moderate (78) and high (136). At the end of study, 44 (20%) deaths were reported. Maximum deaths were reported from group high. Log rank test (mantel –cox) test was done considering there is no difference in the overall survival distributions between the index group in the population as null hypothesis .The chi square value (x2) obtained was 6.567 with 2 degree of freedom, P value = 0.038 < 0.05which is statistically significant and can conclude that the survival distribution of the different types of the index are not equal in the study population (i.e. cohorts are dissimilar). Murray B S et al[10] conducted a study to associate Charlson index with one year mortality in emergency department (ED) patients and the study showed that the log-rank test for difference between the groups was statistically significant ($p < 0.001$).They concluded that the Charlson index was a well-established method to assess comorbid illness burden and to predict one-year mortality for an ED patients with suspected infection.

The Kaplan-Meier plot compares survival distribution between groups. The plot obtained showed a slight deviation from Charlson comorbidity index i.e., cumulative survival proportion appears to be little higher in the moderate group compared to low index group. On the other hand, cumulative survival of high index group was with accordance with Charlson comorbidity index. The last cumulative survival proportion of each curves showed that the proportion of participants that had not died by the end of the study does not appear that different between the intervention group.

CONCLUSION

Prevalence of multimorbid condition is very common in geriatric population, who constitute majority of the Indian population. The study concluded male to female ratio was high in geriatric inpatients. The major reasons for hospital admission were hypertension, diabetes mellitus, chronic obstructive pulmonary disease and ischemic heart disease. The Charlson index is a well- validated research methodology to assess one year mortality, but Kaplan Meier plot in this study exhibits a slight variation from the index. However, cumulative survival of high index population was with accordance with Charlson Comorbidity Index. The study also revealed that it is statistically significant to divide population according to Charlson Comorbidity Index.

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