Original Article

Mortality of Elderly Patients Supported by Mechanical Ventilation at a General Critical Care Unit in a Tertiary Care Centre

Anupam Mandal[1], Supratick Chakraborty[2], Biswajit Ghosh[3], Nandini Chatterjee[4]

Background : There has been a steady rise in the geriatric population in India and increasing number of elderly patients are being admitted in Critical Care Unit (CCU). They need mechanical ventilation during their hospital stay. Hence, there is continued need for evaluation and research to develop a validating scoring systems used to predict the outcome of CCU patients supported by mechanical ventilation.

Objective : Analysis to predict the outcome (survival or mortality) of mechanically ventilated elderly patients in different age groups at the CCU.

Material and Method : A Prospective observational study was done in CCU for a period of one year. A group of 40 elderly ventilated patients greater than 60 years of age (Group 1-elderly case group) and another group of 40 ventilated patients less than 60 years of age (Group-2- control group) were included in the study. A clinical database was collected which included age, sex, Acute Physiology and Chronic health Evaluation II (APACHE II) score and an Sequential Organ Failure Assessment (SOFA) scores were calculated in the first 24 hours of ventilation,indication of mechanical ventilation, co-morbidity, according to the Charlson Comorbidity Index (CCI), functional capacity according to the Barthel Index (BI). Patients outcome (survival or mortality) were analyzed. All the patients in two groups were on ventilation support.

Result : In case group (n=40), mortality was 55%. In control group (n=40), mortality was 52.5%. On comparison of outcome between two groups (case with control group) the difference was not statistically significant (p= 0.8225). In case group, association of outcome to different age groups (60-65 years, 66-75years, more than75years) (p=0.3357) andto gender (p=0.3854) was not statistically significant.

Multivariate logistic regression analysis of the study variables showed APACHE II score to be statistically significant for outcome (p=0.0229).

Conclusion : Mortality of elderly patients supported by mechanical ventilation at CCU were slightly higher(55%) than in mechanically ventilated younger populations (52.5%) though the difference was not statistically significant between two groups (p=0.82). APACHE II, score measured within 24 hours of ventilation was a significant predictor of mortality in the patients on mechanical ventilation.

[*J Indian Med Assoc* 2022; **120(11):** 42-5]

Key words **: Mechanical ventilation, Elderly, Critical care unit outcome, APACHE II Score.**

There has been a steady rise in the population of elderly persons in India with 8.6% of population above the age of 60 years as per 2011 census which is projected to go over 10% by 2020[1].

In this context, the hospital admission rate and demand for critical patient beds are expected to increase exponentially in the coming decade. Older age is characterized by emergence of several complex health states and there is a tendency to restrict their admission to the Critical Care Unit (CCU). Present study compared the mortality outcome of elderly patients with younger individuals in a cohort of critical patients subjected to mechanical ventilation. This study prospectively compared the several variables on the patients requiring mechanical ventilation in CCU, to predict outcome.

Editor's Comment :

- Judicious use of mechanical ventilators in the elderly patients to be considered in the context of individualised risk-benefit ratio in a tertiary care centre.

Study period : A prospective observational study was done over a period of one year (October 2015 to September, 2016) in the Critical Care Unit of a tertiary care hospital.

Study population : The case group comprised 40 ventilated patients of age 60 years and above and control of 40 ventilated adult patients less than 60 years

Department of General Medicine, IPGME&R and SSKM Hospital, Kolkata 700020

[1]MD (General Medicine), Associate Professor and Corresponding Author

[2]MD (General Medicine), Associate Professor, Department of General Medicine, Murshidabad Medical College and Hospital, Berhampore 742101

[3]MD (General Medicine), Ex-postgraduate Student

[4]MD (General Medicine), Professor

Received on : 31/08/2022

Accepted on : 21/10/2022

of age, were included in the study.

Sample size calculation : Sample size was calculated by using the formula $n=z_{(1-\alpha/2)}^2 pq/d^2$.

$z_{(1-\alpha/2)}$ =1.96=value of the standard normal distribution corresponding to a significance level of á (1.96 for a 2-sided test at the 0.05 level). p= expected proportion of mortality from literature 50% or (0.5). q=1-p. d= absolute precision= 0.2(result to be with in 20% of true value).

Taking into account confounding factors for each variable, the sample size was increased by 10% of calculated value and we have taken 40 patients in each groups.

Study variables, inclusion criteria, exclusion criteria, informed consent and ethics committee:

Acute Physiology and Chronic Health Evaluation II (APACHE II)[2] score and an Sequential Organ Failure Assessment (SOFA)[3] scores were measured in the first 24h of ventilation, age, gender, indication of mechanical ventilation, co-morbidity according to the Charlson Index (CCI)[4], functional capacity according to the Barthel index (BI)[5] were documented.

Those patients who died within 24 hours of ventilation were excluded from the study.

Informed consent from relative of patient was taken to include the patient in the study. The study was approved by the Clinical Research Ethics Committee of the Institution. The indications of mechanical ventilation were recorded based on the criteria of the Mechanical Ventilation International Study Group[6] Table 1).

Material and Method

Detailed history and clinical examination of admitted patients were done. The criterion for CCU admission was decided by the admitting primary physician, based on the clinical condition of the patients. Patients from all specialties were admitted. No patients were refused admission in CCU based on the age. No treatment options were restricted to a specific group of patients during CCU stay.

Table 1 — *Distribution of indication of ventilation in cases group (n=40)*

Indication	Frequency	Percent
Exacerbation of chronic respiratory disease	5	12.5%
Coma (Glasgow Coma Scale 8/15 or less)	9	22.5%
Acute lung injury	1	2.5%
Cardiac arrest	1	2.5%
Heart failure	5	12.5%
Multi organ failure	2	5%
Pneumonia	7	17.5%
Post operative	2	5%
Sepsis	8	20%
Total	40	100%

Indication for which ventilation was initiated was noted. In this study, among case (n=40) and control group (n=40), consecutive patients were evaluated when they were ventilated. The records of parameters were taken within 24 hours of ventilation and subsequently daily for one week or until discharge or death, in all patients. Data was recorded which included age, sex, admitting diagnosis, APACHE II (acute physiology and chronic health evaluation) Score, Barthel Index (BI) Score, Charlson Comorbidity Index (CCI) Score, and Sequential Organ Failure Assessment (SOFA) Score, ABG (Arterial Blood Gas), Pulse rate, Blood Pressure, Temperature in Fahrenheit, Fractional inspiratory O_2 concentration, Liver function test, Serum creatinine, Urea or BUN, urine output, Ventilatory rate. Complete Blood Count, and Serum Na, K.

No patients were re-intubated in this study among case and control group patients. The final outcome either survival or death was analyzed.

Results

Demographic Details : In case group, the mean age (Mean ± SD) of patients were 71.1250±8.0166 years with range 60.00 - 92.00 years. Number of patients in case group, in 60 years to 65 years was 37.5%, in 66-75 years was 35.0%, and more than 75 years was 27.5%. In control group, the mean age (Mean±SD) of patients were 41.6750±12.0711 years with range 20.00 - 57.00 years (Fig 1).

Among 40 cases (n=40), 23 patients were male and 17 patients were female. Among 40 control patients, 22 patients were male and 18 patients were female (Fig 2).

Study variable findings

In case group,Barthel Index (BI) score mean ± SD was 12.0000± 13.0973 and in control group mean ± SD was 10.8750 ±12.5006 respectively. Difference of mean BI between two groups was not statistically significant (p=0.6954).

In case group,Sequential organ failure assessment (SOFA) score mean ± SD was 8.9250 ± 3.0834 and in control group,mean ± SD was 9.4250 ± 3.3350 respectively. Difference of mean SOFA between two groups was not statistically significant. (p=0.4884).

In case group,Charlson Co-morbidity Index Score (CCI) mean ± SD was 4.9750 ± 1.8326 with range of 1.0000- 9.0000 and in control group it was 1.9250 ± 3.4744 with a range of 0.0000-21.0000 respectively. The difference of mean CCI between two groups were statistically significant (p<0.0001) .

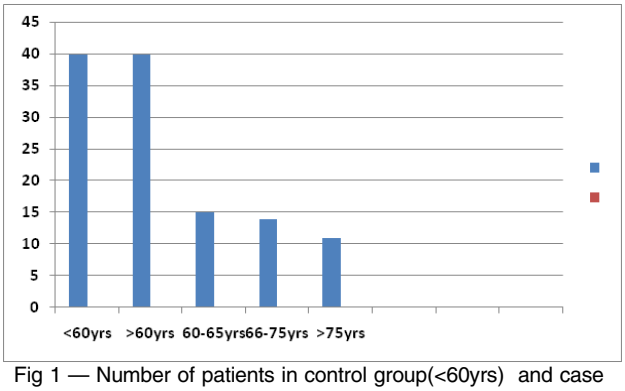

Fig 1 — Number of patients in control group(<60yrs) and case group(>60yrs) and different age groups

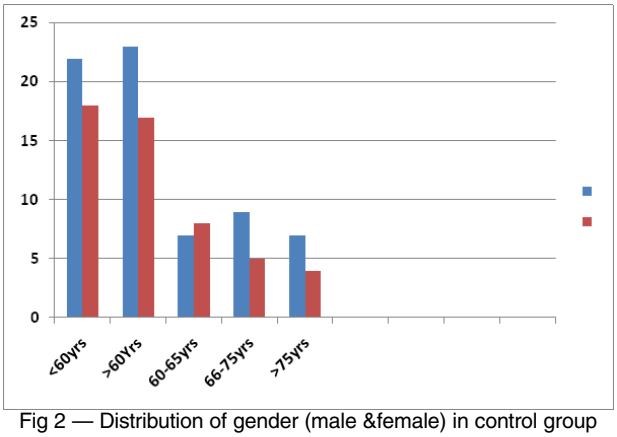

Fig 2 — Distribution of gender (male &female) in control group (<60yrs) and case group (>60yrs) and different age groups

In case group, APACHE II score mean ±SD was 23.7500 ± 6.3559 with range of 10.0000 - 41.0000 and In control group, it was Mean ± SD = 23.6250± 6.8713 with rang of 11.0000- 42.0000. Difference of mean between two groups was not statistically significant (p=0.9329).

Outcome in case group (n=40), mortality was 55%. In 60-65 years, mortality was 27.3%. In 66-75years, mortality was 40.9%. In >75years, mortality was 31.8%. Association of sub-groups of age with outcome in case group was not statistically significant (p=0.3357).

Association of gender (male mortality was 60.9%. female mortality was 47.1%) with outcome in case group was not statistically significant (p=0.3854).

The prediction of prognosis in respect to multiple variables like BI, SOFA, CCI, and APACHEII were calculated by regression analysis (Tables 2 & 3).

We found (Table 2) no variable had significant association with outcome in case group i.e in elderly patients. So in elderly patients, no single variable was a significant predictor of mortality.

We found (Table 3) APACHEII score was significant predictor of mortality in control group of patients. So in relatively younger patients, APACHEII score was significant independent predictor of mortality.

Table 2 — *Multivariate logistic regression analysis for case (n = 40)*

Term	Odds ratio	95%	CI	Coefficient	SE	Z-Statistic	p-Value
SOFA	0.7165	0.1419	3.6178	-0.3334	0.8262	-0.4035-	0.6866
BI	0.8594	0.2054	3.5947	-0.1516	0.7301	-0.2076	0.8356
CCI	0.5976	0.1246	2.8669	-0.5148	0.8000	-0.6434	0.5199
APACHE II	0.1089	0.0103	1.1479	-2.2177	1.2019	-1.8452	0.0650

CI = Confidence Interval; SE = Standard Error

Table 3 — *Multivariate logistic regression analysis for control patients. (n =40)*

Term	Odds ratio	95%	CI	Coefficient	SE	Z-Statistic	p-Value
SOFA	1.9526	0.1527	24.9715	0.6692	1.3003	0.5146	0.6068
BI	0.3232	0.0620	1.6865	-1.1294	0.8429	-1.3399	0.1803
CCI	0.0000	0.0000	>1.0012	-13.3771	316.3449	-0.0423	0.9663
APACHE II	0.0275	0.0012	0.6077	-3.5923	1.5788	-2.2754	0.0229

CI = Confidence Interval; SE = Standard Error

Discussion

We were prompted to do this study because of increasing number of elderly patients being admitted in CCU and their need for mechanical ventilation during hospital stay. There is also reluctance among physicians to put the elderly patients in mechanical ventilation apprehending development of complications subsequently. So we wanted to see if there is any relationship between the mortality outcome and age of the patients. There are several studies that have described the poor results in elderly patients who were subjected to mechanical ventilation with ages over 65 years,[7] 70 years,[8] 80 years,[9] 85 years,[10] Rosenthal, *et al* in a multihospital study concluded that the adjusted odds of death increased with each 5-years age increment[11]. Boumendil A, *et al* in their study concluded that after adjustment for disease severity, ICU mortality rates were higher in elderly patients than in younger populations and age itself explained only a small part of hospital mortality, suggesting that specific information such as functional, cognitive, and nutritional status as well as co-morbidities, should be collected to predict mortality in elderly ICU patients[12]. Vosylius et al. had similar observation with 39% mortality in >75 years age group when compared with 18% in those <65 years (p<0.001)[13]. Stein, *et al* in a study concluded that age >76.9 years was an independent determinant of mortality (p<0.001)[14]. De Rooij, *et al* in a meta- analysis concluded that it is not age *per se* but factors such as severity of illness and pre-morbid functional status that are responsible for poor prognosis[15].

Anon JM, *et al* in a study in Spain, showed that mortality in the ICU was higher in the elderly patients (33.6%) than in the younger subjects (25.9%) (p=0.002)[6].

In India, a study by Sodhi, *et al*[16] showed that no statistical difference was observed between the control and geriatrics age group in overall ICU mortality (p>0.05). However, mortality rates increased in the geriatric population requiring mechanical ventilation and use of inotropes during ICU stay.

In our study, mortality in elderly case group patients were 55% and mortality of control group patients were 52.5%. The difference was not statistically significant in comparison (p=0.82).

Here we found highest mortality was seen in 66-75 years of age (40.9%) which was higher than older age group(>75 years - 31.8%). But difference of mortality among sub- groups (60-65 years, 66-75 years, ->75years) were not statistically significant (p=0.3357).

In a study by Sudarsanam TD, *et al* at CMCH, Vellore, India, concluded that APACHEII Score measured at admission was one of the independent predictor of mortality[17] in the patients on mechanical ventilator. In a study by Nevins and Epstein[18] also showed that the APACHE II associated comorbidities predicted a poorer outcome for COPD patients requiring mechanical ventilation.

In our study, there is no significant difference in outcome in relation to age and in relation to gender. There is no significant difference in outcome in different subgroup of age of elderly people.

Conclusion

Mortality of elderly patients supported by mechanical ventilation at CCU were slightly higher (55%) than in mechanically ventilated younger populations (52.5%) though the difference was not statistically significant between two groups (p=0.82). There should not be any reluctance for ventilation initiation for elderly patients for fear of poor outcome. In CCU, APACHE II, score which has a comparatively high sensitivity in predicting mortality, will be useful to guide to the physician on probable outcome and management decision.Co-morbidity should not restrict the decision for ventilation initiation..

Limitations : Morbidity profile could not be studied here as it needed a long term follow up. Duration of ventilation is not studied here which could be another determinant factor for outcome. Single Centre, short time, small number of study and control population has the limitation of decision making. To draw a inference multi-centre long term study with large number of population will be needed. It is a score based study, individual organ function related study has not been done.

References

1 Malik C, Khanna S, Jain Y, Jain R — Geriatric population in India: Demography, vulnerabilities and health care challenges. *J Family Med Prim Care* 2021; **10(1):** 72-6.

2 Kress PJ, Hall BJ — Approach to the patient with critical illness. In :kasper , Fauci, Hauser, Longo, Jamseson , Loscalzo(eds) Harrisons Principle of internal medicine. 19 th ed. Vol-2. McGraw Hill Education. 2015. pp-1729.

3 Lambdens, Laterre PF, Levy MM, Francois B — The SOFA score—development, utility and challenges of accurate assessment in clinical trials. Crit Care 2019; **23(374):** 1-9

4 Charlson ME, Pompei P, Ales KL, MacKenzie CR — A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis* 1987; **40(5):** 373-83.

5 Mahoney FI, Barthel DW — Functional evalution: the Barthal index. *Md State Med J* 1965; **14:** 61-5.

6 Anon JM, Tello-Gomez V, Higueras-Gonzalez E, Corcoles V, Quintana M, Lorenzo AGD, *et al* — Prognosis of elderly patients subjected to mechanical ventilation in the ICU. *Med Intensiva* 2013; **37(3):** 149-55.

7 Lieberman D, Nachshon L, Miloslavsky 0, Dvorkin V, Shimoni HA, Zelinger J, *et al* — Elderly patients undergoing mechanical ventilation in and out of intensive care units**:** a comparative, prospective study of *57*9 ventilations. *Crit Care* 2010; **14:** R48

8 Esteban A, Anzueto A, Frutos-Vivar F, Alia I, Ely EW, Brochard L, *et al* — Outcome of older patients receiving mechanical ventilation. *Intensive Care Med* 2004; **30:** 639-46.

9 Somme D, Maillet JM, Gisselbrecht M, Novara A, Ract C, Fagon JY — Critically ill old and the oldest-old patients in intensive care: short- and long -term outcome. *Intensive Care Med* 2003; **29:** 2137-43.

10 Ip SP, Leung YF, Ip CY*, M*ak WP — Outcomes of critically ill elderly patients: is high-dependency care for geriatric patients worth while? *Crit Care Med* 1999; **27:** 2351-7.

11 Rosenthal GE, Kaboli PJ, Barnett MJ, Sirio CA — Age and the risk of in hospital death: insights from a multi hospital study of intensive care patients. *J Am Geriatr Soc* 2002; **50:** 1205-12.

12 Boumendil A, Somme D, Garrouste-Orgeas M, Guidet B — Should elderly patients be admitted to the intensive care unit? *Intensive Care Med* 2007; **33:** 1252-62.

13 Vosylius S, Sipylaite J, Ivaskevicius J — Determinants of outcome in elderly patients admitted to the intensive care unit. *Age Ageing* 2005; **34:** 157-62

14 Stein FD, Barros RK, Feitosa FS, Toledo DO, Silva Junior JM, Isola AM, *et al* — Prognostic factors in elderly patients admitted in the intensive care unit. *Rev Bras TerIntensiva* 2009; **21:** 255-61.

15 de Rooij SE, Abu-Hanna A, Levi M, de Jonge E — Factors that predict outcome of intensive care treatment in very elderly patients: A review. *Crit Care* 2005; **9:** R307-14.

16 Sodhi K, Singla MK, Shrivastava A, Bansal N — Do intensive care unit treatment modalities predicts mortality in geriatrics patients :An observational study from an Indian intensive care unit. *Ind J of Crit Care Med* 2014; **18(12):** 789-95.

17 Sudarsanam TD, Jeyaseelan L, Thomas K, John G — Predictor of mortality in mechanically ventilated patients. *Postgrad Med J* 2005; **81:** 780-3.

18 Nevins ML, Epstein SK — Predictors of outcome for patients with COPD requiring invasive mechanical ventilation. *Chest* 2001; **119:** 1840-9.