ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
Index Copernicus Value: 68 . 16
PubMed - National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 5, Issue – 6, December - 2020, Page No. : 87 - 94

Application and Validation of "Walter LC1-Year Prognostic Index" For Mortality Prediction In Older Adults After Hospitalization For Medical Illness

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Citation this Article: Nitesh Kumar Bauddh, Meenaxi Sharda , Jitendra Meena, Pravin Kumar, Sachin Shyoran, "Application and Validation of "Walter LC1-Year Prognostic Index" For Mortality Prediction In Older Adults After Hospitalization For Medical Illness", IJMSIR- December - 2020, Vol – 5, Issue - 6, P. No. 87 – 94.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: For geriatric patients, hospitalization for any acute medical illness is followed by progressive physical decline, resulting in high mortality rates in successive year after discharge. Prognostic indices can provide basis for discussion about the goals of care and therapy, influence treatment decisions and identify high-risk patients for interventions. Our study externally validates the "Walter LC 1- year Prognostic index" meant for mortality prediction in older adults after hospitalization for medical illness.

Material and methods: 194 hospitalized elderly patients (>65years) were categorized into risk groups at the time of discharge as per "WALTER LC 1-YEAR PROGNOSTIC INDEX" which includes male sex, activities of daily living dependencies (ADL) at discharge, co-morbid conditions (congestive heart failure, solitary cancer/hematological cancer, metastatic cancer), and laboratory parameters (serum creatinine and serum albumin). All patients were followed up for 1-year to assess their observed mortality.

Results: The mean age of patients was 71.4 years. 82 (42.3%) were females, and 112 (57.7%) were males. 1-year mortality was found to be significantly associated with length of hospital stay (p=0.003), Functional status at the time of discharge (p=0.00), presence of CVA (p=0.015), Metastatic cancer (p=0.00), low Serum albumin (p=0.00) and high serum creatinine (p=0.00), however no significant association was observed with age (p=0.436), gender (p=0.375), CHF (p=0.107) and solitary cancer (p=0.884). 1-year mortality was 4% in the lowest risk group (0-1 points), 30% in the risk group with 2-3 points, 73% in 4-6 points risk group, and 91% in the highest risk group with > 6 points (p=0.00). The area under the ROC curve for overall score was 0.87.

Conclusion: "Walter LC 1-year prognostic index" is successfully applicable and validated in Indian population. This index may be useful in clinical settings for proper planning of health care services, informed discussions regarding prognosis with patients /family members/care givers and for risk adjustment in acutely ill elderly patients.

Keywords: Elderly patients, Walter LC 1- year Prognostic index

Introduction

A demographic shift has occurred in the last decades in developing countries resulting in a considerable rise in the number of elderly patients. For many elderly patients, an acute medical illness requiring hospitalization is followed by progressive physical decline, resulting in high rates of mortality in successive year following discharge. This devastating outcome is a common result of the older adults "cascade to dependency", in which normal ageing changes combine with bed rest or immobility, result in irreversible physiologic changes and poor outcomes at discharge.

Prognostic information can provide basis for discussion about the goals of care and therapy, influence treatment decisions and identify high-risk patients for interventions. We aim to externally validate the "Walter LC 1- year Prognostic index" in Indian population.

Materials And Methods

Our study externally validates the "Walter LC 1- year Prognostic index[1]" meant for mortality prediction in older adults after hospitalization for medical illness by using the simple bedside scoring system after stratifying them in associated risk groups.

As per Walter LC 1- year prognostic index, we noted the following risk factors from each of the 4 domains (demographic variables, functional status, medical diagnosis and laboratory values), namely male sex, activities of daily living dependencies (ADL) at discharge, co-morbid medical conditions including congestive heart failure, solitary cancer/hematological cancer and metastatic cancer, laboratory parameters including serum creatinine and serum albumin levels (table 1).

A total of 200 consecutive patients, aged greater than 65 years old were studied. Out of these 6 patients (3 %) were lost to follow up and hence excluded from statistical analysis. All selected subjects underwent detailed clinical and laboratory examination and according to simple bedside scoring system, they were categorized into their respective risk groups at the time of discharge, by adding up the points for each risk factor present and all patients were followed up for 1-year to assess their observed mortality.

Sn.	Risk Factors	Points
1.	Male sex	1
2.	ADL dependencies at discharge	
	- Dependent in 1-4 ADLs	2
	- Dependent in all ADLs	5
3.	Co-morbid conditions	
	- Congestive heart failure	2
	- Cancer	
	□ Solitary cancer/Hematological malignancy	3
	Metastatic cancer	8

4.	Laboratory values on admission	
	- Serum creatinine (mg/dl) >3.0	2
	- Serum albumin(g/dl)	
	□ 3.0-3.4	1
	□ <3.0	2

Table 1: scoring points of Walter LC index[1]

Observations And Results

A total of 200 consecutive patients aged greater than or equals to 65 years old were studied (table 2). Out of these 6 patients (3%) were lost to follow up and hence excluded from statistical analysis. The mean age of patients in the validation cohort was 71.4 years. Out of 194 patients 82 (42.3%) were females, and 112 (57.7%) were males.

In our validation cohort no significant association is observed between age (p=0.436) and gender (p=0.375) of patients with 1-year mortality whereas association with length of hospital stay (p=0.003) and Functional status (p=0.00) at the time of discharge is statistically highly significant (Table 3).

Statistically significant association is observed between presence of CVA (p=0.015) and Metastatic cancer (p=0.00) with 1-year mortality however association of congestive heart failure (p=0.107) and solitary cancer (p=0.884) with 1 year mortality is statistically insignificant in our validation cohort. Also low Serum albumin (p=0.00) and high serum creatinine (p=0.00) levels are found to be significantly associated with 1 year mortality in our study (Table 3).

Table 2: Charatcteristics of patients in our validation cohort

CHARACTERISTICS OF PATIENTS IN VALIDATION COHORT			
S.No	CHARACTERISTIC OF PATIENTS	VALIDATION COHORT (n)=	194
		NUMBER	PERCENTAGE
1	AGE-YRS		
	65-69	91	46.9%
	70-74	40	20.6%
	75-79	35	18.0%
	80-84	18	9.3%
	>84	10	5.2%
2	SEX		
	WOMEN	82	42.3%
	MEN	112	57.7%
3	ACTIVITIES OF DAILY LIVING(ADL) DEPENDENCY AT DISCHARGE		
	INDEPENDENT IN ALL ADLS	108	55.7%
	DEPENDENT IN 1-4 ADLS	65	33.5%
	DEPENDENT IN ALL ADLS	21	10.8%
4	COMORBID CONDITIONS		
	MYOCARDIAL INFARCTION	55	28.4%
	CONGESTIVE HEART FAILURE	32	16.5%
	CEREBROVASCULAR DISEASE	30	15.5%
	DEMENTIA	0	0.0%
	CHRONIC OBSTRUCTIVE PULMONARY DISEASE	13	6.7%
	DIABETES MELLITUS	26	13.4%
	SOLITARY CANCER	4	2.1%
	METASTATIC CANCER	10	5.2%
5	HOSPITAL STAY		
	1-7 DAYS	170	87.6%
	>7 DAYS	24	12.4%

Table 3: Association of patient characteristics with mortality

Charachterstic	Subgroup	Total Patients(N)	1Year Mortality	P Value
Age Group (Years)	65 – 69	91	37(41%)	0.436
	70 – 74	40	21(53%	
	75 – 79	35	19(54%)	
	80 – 84	18	10(56%)	
	> 84	10	03(30%)	
Functional Status	Independent In All ADL	108	25(23%)	0.00
	Dependent In 1 – 4 ADL	65	45(69%)	
	Dependent In All ADL	21	20(95%)	
Hospital Stay	≤ 7 DAYS	170	72(42%)	0.003
	> 7 DAYS	24	18(75%)	
S.Creatinine (mg/dl)	< 1.5	139	52(37%)	0.00
	1.5 – 3.0	39	25(64%)	
	> 3.0	16	13(81%)	
S.Albumin (mg/dl)	< 3.0	75	47(63%)	0.00
	3 – 3.4	64	29(45%)	
	3.5 – 3.9	40	12(30%)	
	> 4.0	15	02(13%)	

The risk score was calculated for patients in each risk group, according to the Bedside scoring system of Walter LC index. At the time of discharge from hospital, 46 patients (23.7%) had 0-1 risk score, 60 patients (30.9%) had 2-3 risk score, 56 patients (28.9%) had 4-6 risk score, and 32 patients (16.5%) had >6 risk score.(Table 4)

In the validation cohort 1-year mortality was 4% in the lowest risk group (0-1 points), 30% in the risk group with 2-3 points, 73% in 4-6 points risk group, and 91% in the highest risk group (> 6 points). The association between bedside risk scoring and 1-year mortality is statistically significant (p value=0.00).[Table 4,Fig. 1]

Bedside Risk Scoring		Outcome			
	Total No Of Patients	Alive		Mortality	
	N (%)	N	%	N	%
0-1	46 (23.7%)	44	95.70%	2	4.30%
2-3	60 (30.9%)	42	70.00%	18	30.00%
4-6	56 (28.8%)	15	26.80%	41	73.20%
>6	32 (16.5%)	03	9.40%	29	90.60%
Total	194	104	53.60%	90	46.40%

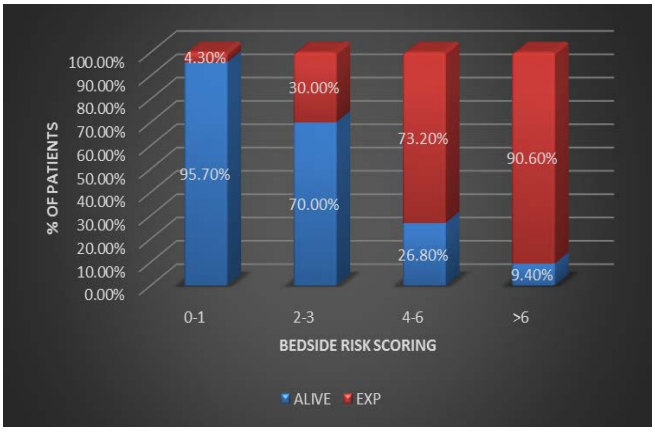


Fig.1: Bedside risk scoring and 1-year Mortality

Discussion

Our study externally validates the "Walter LC 1- year Prognostic index" meant for mortality prediction in older adults after hospitalization for medical illness by using the simple bedside scoring system after stratifying them in associated risk groups.

There is no significant association observed between age of patients and 1-year mortality (p=0.436) at 1-year of follow up which suggests that the chronological age alone is not an important factor for 1-year mortality whereas cumulative duration of disease burden and functional impairment, irrespective of the age may decide the final outcome. This is in consistence with studies done by Walter LC et al and Pilotto et al[2].

The association between sex and 1-year mortality is not statistically significant (p=0.375) after 1-year of follow up which may be because of small sample size (n=194) in our validation cohort. This is in contrast to the study done by Walter LC et al[1], in which the association between male sex and 1-year mortality was significant (p=0.01) after adjustment for co-morbid illness and functional status in their validation cohort. The association between male sex and 1-year mortality was also significant in study done by Rozzini et al[3].

In our study during 1-year follow up, 42.4% patients whose period of stay in hospital was ≤ 7 days died whereas 75% patients whose period of hospital stay was > 7 days died. The Association between length of hospital stay and 1-year mortality is statistically significant (p=0.003) which corresponds to results of study done by Levine et al[4] but is in contrast to result of Walter LC et al[1] in which the association between length of hospital stay and 1-year mortality was found insignificant after adjustment for discharge functional status.We also found that among all patients who were independent in all ADLs, 76.9% (83) were alive and 23.1% (25) expired. Among patients who were dependent in 1-4 ADLs, 30.8% (20) were alive and 69.2% (45) expired whereas among patients who were dependent in all ADLs only 4.8% (1) was alive and 95% (20) expired. The Association between 1-year mortality and dependency of functional status at the time of discharge is statistically significant (p=0.00) which in concordance with results of Walter LC et al1 and other studies done by Inouye et al5, Pilotto et al2, Rozzini et al3 and 2-year mortality index of Drame et al6.In our Validation cohort according to bedside risk scoring system, 1-year mortality was 4.3% in the lowest-risk group, 30% in the group with 2-3 points, 73.2% in group with 4-6 points, and 90.6% in highest-risk group. Therefore the association between bedside scoring system and 1-year mortality is statistically significant (p=0.00).The area under the ROC curve for overall score is 0.87. Thus the point system has good discrimination in the validation cohort, with large differences in 1-year mortality between the low-risk (4%) and high-risk (91%) groups.(Fig 2)While in validation cohort of Walter LC et al1, 1-year mortality was 4% in the lowest-risk group (0-1 points), 19% in the risk group with 2-3 points, 34% in risk group with 4-6 points, and 64% in highest risk group (>6 points).The area under ROC curve for overall score was

0.79. Higher mortality in highest risk group (>6 points) observed in our study as compared to others may be attributed to small sample size and limited resources in managing seriously ill patients in our setting.(table 6)In the validation cohort of Levine et al4, 1-year mortality was 14%, 24%, 30%, 42% in the risk groups with 0-1 point, 2 points, 3 points, >4 points respectively (AUC = 0.65) whereas in the validation cohort of Drame et al6, 2-year mortality was 21.7%, 48.5%, 65.4% in low risk group, medium risk group, and high risk group respectively (AUC = 0.71)

Table 6: Comparison of Walter LC index in different cohorts

Risk Group Points	1 Yr Mortality In Derivation Cohort (Walter LC et al)	1 Yr Mortality In Validation Cohort Walter LC et al)	6 Month Mortality In Validation Cohort (Rozzini et al)	1 Yr Mortality In Validation Cohort (Our Study)
0-1	13%	4%	4%	4.3%
2-3	20%	19%	10%	30%
4-6	37%	34%	25%	73.2%
>6	68%	64%	46%	90.6%
AUC	0.75	0.79	NA	0.87

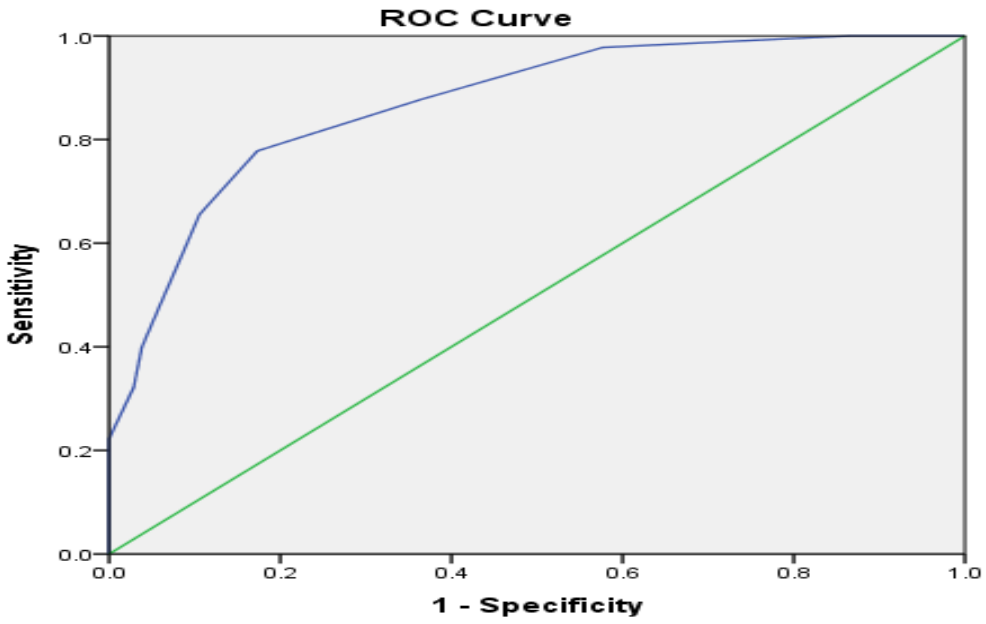
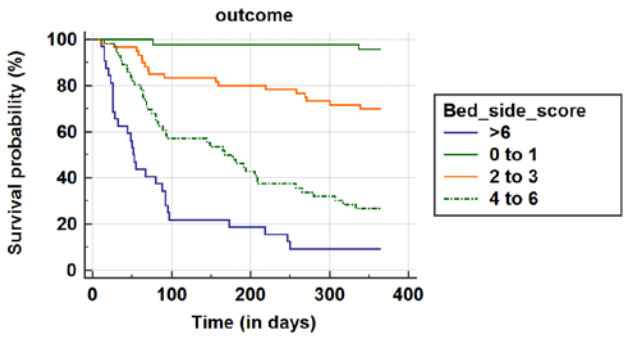


Fig 2: Receiver Operating Characteristic (ROC) curve. (AUC = 0.87)

In our study Kaplan-Meier survival curves of the 4 risk groups according to bedside scoring system suggest that, percentage of survival probability decreases maximum in high risk group having bedside score of >6 followed by 4-6, 2-3, 0-1 bedside score, as the time passes during follow up of 1-year (fig 3). This corresponds to the studies of Levine et al[4], Walter LC et al[1] and Rozzini et al[3].

Fig 3: Kaplan-Meier Survival Curves for our Validation cohort



Conclusion

Our validation cohort has shown very good discrimination (as per ROC) compared to other studies, with large difference in 1-year mortality between the low risk and high risk groups. Hence, "Walter LC 1-year prognostic index" for mortality prediction in older adults after hospitalization for medical illness is successfully applicable and externally validated in Indian geriatric population It proves the generalized applicability of this index to another location and patient group.Our study suggests that this index may be useful in clinical settings for proper planning of health care services, informed discussions regarding prognosis with patients /family members/care givers and for risk adjustment at any geographical site/different population groups irrespective of disease and its treatment.Clinicians may use this index to supplement and furnish confidence in their assessment of prognosis. Hence, combining both a prognostic index and clinician's judgment in every individual case will result in more optimized approach in management as well as resource utilization (financial and manpower) of family. This is more so important in developing country like India.Further this index may be useful in identifying elder low-risk patients who may benefit from screening as well as identifying younger high-risk patients for whom the benefits of screening outweigh the harms. For example, a 65 year old male smoker with heart failure, difficulty in bathing, walking, toileting, eating and transferring from bed to chair may not be an appropriate candidate for colorectal cancer screening because his probability of 1-year mortality is greater than 64% (8 points). On the other hand, a 75 year old woman with no major co-morbid conditions and excellent functional status has a high probability of surviving 1-year and would be a good candidate for screening despite her advanced age.

Limitations of Study

- Small single center study.
- Post-hospitalization deterioration or improvement in functional status and clinical condition of patient especially an elder one depends on multiple socio-economic factors which were not taken into account, but might have affected the final outcome.

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