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"Mpm0 III (Mortality Probability Model) Admission Scoring System as a Predictor of Mortality in SICU Patients"

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ABSTRACT

SICU has a wide array of critically ill patients either in a pre or post operative stage with varying mortality and morbidity, expecting this mortality or morbidity of particular patient at SICU admissions allow surgeon to predict outcome which can be used to counsel patients relatives, improve management, decide the aggressiveness with which patient should be treated. MPM III is a third generation admission mortality scoring system. This study here tries to assess prognostic ability of MPM III in predicting death at hospital discharge on basis of admission data in an adult SICU. *Method:* Data was collected prospectively from 100 consecutive patients admitted at surgical ICU, using admission data MPM III score and probability calculated. *Results:* Mean age of the study was 50.5 years, leading cause of admission was perforation peritonitis followed then by acute pancreatitis. Cut off MPMIII probability of death score was >11.3. The area under curve (AUROC) was 0.771 and 95% confidence interval of 0.677 to 0.849.Sensitivity of 95.16%, specificity of 76.32%, PPV and NPV being 75.70% and 70% respectively with significance p value <0.0001.On application of linear analysis and calculation of SMR, MPM III had SMR of 1.93. The MPM III curve shows a larger underestimation below predicted probability of about 0.4 and an less underestimation above this value. *Conclusion:* even though MPM III is good , easy ,simple admission scoring system predicting mortality in a surgical ICU model, it has tendency to slightly underestimate mortality for border line patients.

Key Words- Mortality prediction, MPM III, Surgical ICU population, Admission scoring.

INTRODUCTION

In recent years number of surgical in-patients have been increased, along with it the need for critical care for surgical patients. It is very crucial in having good communication with patient and their relatives regarding outcome of the patient in recent times and also in taking early decisions related to treatment of these critically ill surgical patients. It is essential to know the prognosis of the patient on admission to ICU to inform the risks to the anxious relatives and also to decide the suitable treatment modalities of the patient. These decisions have been eased or guided by prognostic prediction models. Since MPM II .[1]. established in 1990was over predicting mortality, a new MPM III mortality prediction model, was created in 2005,using a database of 124,885patients were included from North American hospitals.[2]. MPM0 is also an integral part of the "Rapoport–Teres methodology" [3]. MPM III provides an assessment of acuity based on age and 15 binary variables measured at the time of or within 1 hr of ICU admission. Two new model terms were added: "zero factors" (absence of every MPM0-II risk factor except age) and full resuscitation code status at ICU admission. It contains seven interaction terms between age and systolic blood pressure ≤90, metastatic neoplasm, cirrhosis, cardiac dysrhythmia,

intracranial mass, cardiopulmonary resuscitation, and coma/deep stupor. Interaction terms are needed when the effects of two variables are not additive. A typical scoring chart looks like:

PHYSIOLOGY		CO EFFICIENT	
Coma/deep stupor (GCS 3 or 4)		2.050514 (0.138)	
Heart rate (≥ 150 bpm)		0.433188 (0.070)	
Systolic blood pressure (≤ 90 mm Hg)		1.451005 (0.118)	
CHRONIC DIAGNOSES			
Chronic renal insufficiency		0.5395209 (0.042)	
Cirrhosis		2.070695 (0.269)	
Metastatic neoplasm		3.204902 (0.234)	
Acute diagnoses			
Acute renal failure		0.8412274 (0.043)	
Cardiac dysrhythmia		0.8219612 (0.211)	
Cerebrovascular incident		0.4107686 (0.050)	
GI bleed		-0.165253 (0.054)	
Intracranial mass effect		1.855276 (0.161)	
OTHER			
Age (per year)		0.0385582 (0.001)	
CPR before admission		1.497258 (0.203)	
Mechanical ventilation within 1 hr of Admission		0.821648 (0.028)	
Medical or unscheduled surgical admit		0.9097936 (0.047)	
Zero factors (no factors other than age from list above)		-0.4243604 (0.087)	
Full code		-0.7969783 (0.043)	

INTERACTION TERMS			
Age × coma/deep stupor		AGE × -0.0075284 (0.002)	
Age×systolic blood pressure(≤		AGE × -0.0085197	

90mmHg)		(0.002	
Age ×cirrhosis		AGE × -0.0224333 (0.005)	
Age× metastatic neoplasm		AGE × -0.0330237 (0.004)	
Age× cardiac dysrhythmia		AGE × -0.0101286 (0.003)	
Age× intracranial mass effect		AGE × -0.0169215 (0.002)	
Age× CPR prior to admission		AGE × -0.011214 (0.003)	
Constant		_5.36283 (0.102)	
		lOGIT	

The relationship between the MPM0-III and vital status at hospital discharge is given by the equation:
Logit = constant (-5.36283) +individual co efficient for each risk factor present
Probability of death = $e^{logit}/ (1+e^{logit})$.

Several validations has occurred regarding other mortality prediction models. MPM0 III has done well in North American [6,7] and few European countries and has been validated[5,8]. It's also validated in few low economic countries with some calibrations [9].The purpose of our study is to see the usefulness of MPM0-III admission scoring system in predicting mortality of the surgical group of patients requiring intensive care. Here we also try to see how well it suits Indian government set up by taking a small sample size in Jodhpur government medical college.

METHOD & MATERIAL

The present study included Surgical Patients getting admitted in ICUs of Dr. S. N. Medical College and Associated Hospitals. Database collection will include documentation of ICU admission data (recorded within ±1 h) describing **INCLUSION CRITERIA:** surgical Patients getting admitted in ICUs, Patients aged ≥18 years, Patients with trauma, Surgical patients requiring ICU care, Patients with Post operative ICU care. **EXCLUSION CRITERIA**: Patients aged <18 years, Burns, coronary artery bypass grafting, valve replacement, Patients with readmission. A total 100 consecutive patients were included . All patients were followed up for one month and death within a month of ICU admission was defined as the final outcome measure. **STUDY DESIGN:** Prospective observational study. All data were analysed manually.

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OBSERVATION AND RESULTS

Out of 100 patients, 70 were males and 30 were females. Majority of subjects i.e. 24% belongs to age group 20-30 years. Overall mean age was 50.6 years in study population. Mean age was 48.94 years in males. Mean age of survivors was 47.53±20.59 and non survivors was 51.55±18.32. Average length of stay before ICU admission was 3.81days. Intra hospital stay of the patients before ICU admission was post operative ward or general ward(57%) in maximum patients, operation theatre (34%) and emergency room (8%). Patients shifted from wards had highest mortality of 71.3%. 62% of the patients was under vasoactive drugs, they carried 75.5% mortality. Most of the admissions were un planned, out of 91 patients, of which 33 survived and 58 expired. In the physiological parameters, patients with acute respiratory infection, lower GCS/coma , hypothermia, tachycardia, hypotension, acute renal failure, emergency surgeries were associated with significant mortality. On application of linear analysis for MPM0-III probability of death, the observed mortality was 62%, while MPM0-III expected mortality was 32% with a O/E ratio of 1.93:1 and SMR of 1.93.The Receiver Operating Characteristic (ROC) Curve for MPM0-III probability of mortality score is depicted in Figure (1)the area under curve (AUROC) being 0.771, and a confidence interval of 0.677 to 0.849 , with cut off MPM0-III probability of death being >

11.14%, Sensitivity of 95.16%, specificity of 76.32%, positive predictive value (PPV) and negative predictive value (NPV being 75.70% and 70% respectively with significance p value <0.0001.The mean MPM III β-score of -2.27 and -0.54 were observed in the survived and expired patients respectively. The mean MPM III probability of mortality for the population under study was 33.41% and mean of 16.80% in the survived and 34.39% in the expired patients was calculated with p value of <0.0001.it was noted during the study that MPM III β-score was more negative for survived patients and was less negative or positive among patients who expired and greater the MPM III probability score higher death rates was expected.

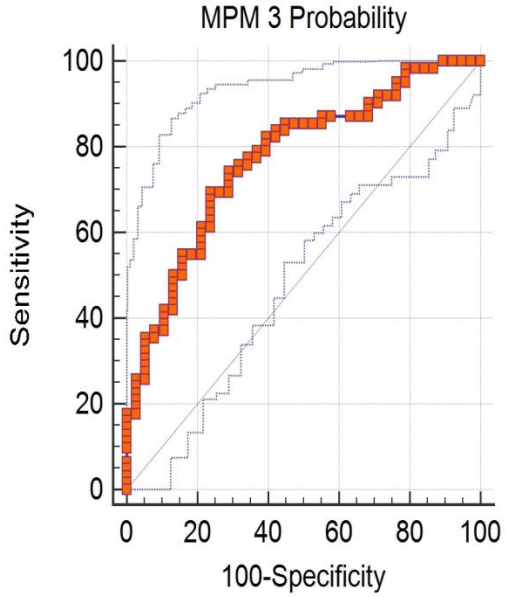

Figure 1: MPM0-III Probability of Death

Sample size = 100 (38 + 62)
Disease prevalence = 62.0 %
AUC = 0.771; p value < 0.0001
Cut Off SAPS III score is > 11.14 with a
Sensitivity of 95.16%
Specificity of 76.32 %
PPV of 75.70%
NPV of 70.00%
+LR ratio of 1.91%
–LR ratio of 0.26%

CONCLUSION

A prospective observational study of 100 consecutive patients admitted at surgical ICU,in MGH and MDMH, under Dr. S. N. Medical College, Jodhpur, Rajasthan using admission data into SICU, MPM III mortality score and probability calculated. The following conclusions were drawn. patients with acute respiratory infection, lower GCS/coma(mean <8.96), elderly patient(>50yrs), tachycardia, hypotension, Acute renal failure(creatinine value >3.5 had 85.6% mortality),unscheduled surgical admission were commonly associated with significant mortality. On application of linear analysis and calculation of SMR, it had SMR of 1.93 suggesting that MPM III which was initially studied on North American population tends to underestimate mortality rates when applied to Indian hospital set ups. The MPM III curve shows a larger underestimation below predicted probability of about 0.4 and a less underestimation above this value.MPM0 III had sensitivity and specificity of 95.16% &76.32%, Cut off probability of death score in MPM III was 11.34, denoting patients above this scoring limit had higher probability of death n poor outcome.

Thus to summarize, MPM III mortality model was deemed good mortality predictor in north American study[2,6,7,8]. and few European studies[4], in our current study we saw it under estimating mortality especially with patients who are below predicted probability of about 0.4. even though MPM0 III is an easy scoring system which can be calculated within 1hr of SICU admission ,with only physical variabilities into consideration and a good mortality predictor care should be taken

when MPM0 III is used in such patients. This underestimation in our set up may also indicate some improvement should be made in management of these borderline patients or might require some calibrations specific to Indian subcontinent.

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