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Implementation of revised Baux Score to Predict Mortality Burn Injured Patients in Burn Unit of dr. Cipto Mangunkusumo General Hospital, Jakarta

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Abstract

Introduction. Implementation of stratification in burn injured patients referred to a very helpful approach for surgeon distinguishing severity of problems as well as predicting the outcome and lead a surgeon to make an accurate decision and a guidance to deliver patient's condition to his/her family. A stratification tools for prediction should be simple and applicable in clinical setting. It also feasible to be applied for clinical use, research purpose, and system audit. Amongst scoring systems in burn surgery, revised Baux score is the one. The study is aimed to run validation in our burn characteristics.

Method. A study run to find out validation for revised Baux score, prior to its use for application in our setting. We run cohort study enrolled burn injured patient treated during period of January 2010 to December 2012, retrospectively. Total body surface area involved, age and inhalation injury referred to variables subjected to statistical analysis.

Results. Out of 442 burn injured patient, there were 234 subjects included in the study. Statistical analysis using Hosmer and Lemeshow test addressed to evaluate calibration of scoring performance showed p value of $p = 1$ (> 0.05), and for its precision we found the performance of discrimination of r-Baux score showed the area under curve (AUC) of 0.87 (CI 95%; 0.825–0.915), showing a p value of < 0.001 , and sensitivity 77.9% and specificity 76.9%.

Conclusion. On validation, revised Baux score provide a good performance and likely would provide a merit of its clinical application.

Keywords: *validation, revised Baux score, age, TBSA, inhalation injury, mortality*

Introduction

Burn injury remains a major problem particularly in low to middle income countries.¹ Unfortunately, nowadays morbidity and mortality rate in Indonesia is not well documented yet.^{2,3} Based on data of World Health Organization (WHO) in 2008, mortality rate as well as crude death rate of those in South East Asia countries showed a global proportion as the highest compared to other countries worldwide. The mortality rate reach up 184.000 per annum, crude death rate reach up 11.6 per 100.000 population, with death global proportion of 59%.¹ In that case, Indonesia as member of South East Asia should pay more for attention to burns injury. Strategic way in accordance to demographic characteristic with consideration to specific characteristic in the island of Indonesia should be instituted to reduce mortality rate.

There were studies run to provide predictive values of burns mortality. Such a predictive provided through stratification to those during the first presentation. This was very helpful for a surgeon to find out what the problem encountered is and let he decide a proper way to treat an accurate and quick intervention that saves live. Any unsuccessful in recognition leads to unfavorable outcome, or even worst. And, it believed that hospital death indeed predictable and preventable. Thus, early detection of problem encountered referred to preventive step.^{4,5,6} In clinical practice, the concept of stratification through a scoring system is well accepted worldwide. A scoring system for predictive purpose should be simple and easy to be

applied.^{7,8,9} With this system, any health personnel will then have a simplicity to predict mortality in clinical setting and help a surgeon to make a right decision to solve problems of life threatening. It also might be used for research purpose, and finally for system audit.^{9,10,11}

Somehow, as it might be used regionally, the scoring system should pass the validation first. A process of validation is addressed to find out the performance of such a system in a population of which is differed to the population where the scoring system proposed and established. The process is set up into accuracy (calibration) and precision (distinguishing), where accuracy representing the appropriateness between a prediction with clinical facts and the precision representing the ability of distinguishing those who will survive and those who is not.⁹ Amongst proposed scoring system in burns field, there's a simple and feasible to be applied named revised Baux (abbreviated as, r-Baux) score. Such a score has been studied and applied in many centers worldwide,^{7,8,12,13,14} but so far in our unit there's no established scoring system is used yet. Thus, we run a study addressed to find out the feasibility of this scoring system to be used, in our population's characteristics.

Method

We performed a cohort study retrospectively. All acute burns injured subjects admitted in burns unit of dr. Cipto Mangunkusumo General Hospital were included. Those who were not met the criteria i.e.

chronic burns, none of variables data, and lost follow up were excluded. Those variables were age, burned area, and inhalation injury; subjected to statistical analysis.

Calibration of r-Baux score performance was subjected to Hosmer–Lemeshow test. Performance of distinguishing tested using the area under the curve of receiver operating characteristic (ROC). Cut-off point of the sensitivity and specificity of r-Baux score is the point to be found. Ethical committee of FMUI and research bureau of dr. Cipto Mangunkusumo General Hospital approved the study (743/UN2.F1 /ETIK/2015, 7 September 2015).

Results

We found 442 burns injured subjects treated during period of January 2010 to December 2012. Out of this, there were 234 subjects enrolled; male of 168 subjects (72%) and female of 66 subjects (28%). These burns injured subject were classified as burns injury (flame injury) of 143 subjects (61.1%) and scald of 52 subjects (22.2%), and others (boiled cooking oil, hot steam, etc.). Those were divided into age group, i.e. group of 0–10 years old (25.6%), 31–40 years old (24.4%), and 21–30 years old (20.1%). Burned area which was represented as total body surface of burned area (TBSA) were classified into group and we found the most found group was of 11–20% (61 subjects, 26.1%) and of 31–40% (39 subjects, 15.4%) in the second place. With this grouping, it was clearly seen that mortality reached up 100% found in those group of more than 60% TBSA. There were 47 subjects with inhalation injury (20.1%). In this point of view, subject's characteristic of age group described as follow: inhalation injury mostly found in group of 31–40 years old and 41–50 years old in the second place.

Overall mortality was 44.44%. In the perspective of burned area involved, the highest rate found in group of more than 60% TBSA and 51–60% TBSA in the second place, and 41–50% TBSA in the third place.

Mortality in subjects with inhalation injury reached up 93.6%, whilst those without inhalation injury reached up 32.1%. Table 1 and 2 showing the mortality of subjects with the perspective of age grouping, burned area involved, and inhalation injury. Statistical analysis using Hosmer and Lemeshow test that addressed to evaluate calibration of scoring performance showed p value of $p = 1$ (>0.05), which was such a scoring system has a good accuracy to be applied

in our center. When we were dealing with precision, we found the performance of discrimination of r-Baux score showed the area under curve (AUC) of 0.87 (CI 95%; 0.825–0.915), showing a p value of <0.001 . This was just showing a strong category.

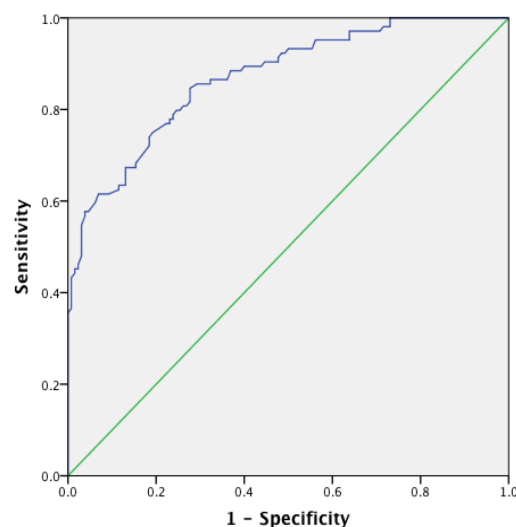


Figure 1. Receiver operating characteristic (ROC) curve of revised Baux score.

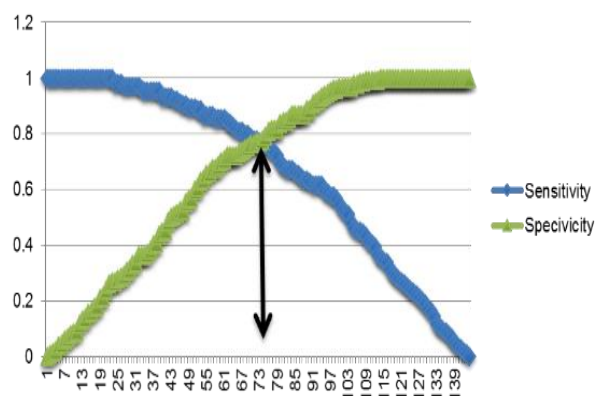


Figure 2. Cut-off point of sensitivity and specificity of revised Baux score.

With such a characteristic of available data, we found the cut-off point of the sensitivity and specificity at point of 72 with 77.9% of sensitivity and 76.9% of specificity.

Table 1. Subjects characteristic without inhalation injury

		TBSA									
Age		0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100
W/o Inhalation injury											
0–10	%	0	0	44.4	60	80	100	100	–	–	–
	n	13	19	9	10	5	1	1	–	–	–
11–20	%	0	0	0	33.3	–	–	–	–	–	–
	n	6	9	2	3	–	–	–	–	–	–
21–30	%	0	0	25	100	100	71.4	100	100	–	–
	n	4	12	8	4	1	7	1	1	–	–
31–40	%	0	11.1	57.1	54.4	71.4	75	100	–	–	–
	n	2	9	7	11	7	4	1	–	–	–
41–50	%	33.3	12.5	0	0	0	–	100	100	–	–
	n	3	8	3	2	1	–	1	2	–	–
51–60	%	0	0	33.3	0	–	–	–	–	–	–
	n	1	1	3	1	–	–	–	–	–	–
61–70	%	–	0	–	–	100	–	100	–	–	–
	n	–	1	–	–	1	–	1	–	–	–
71–80	%	–	–	–	–	–	–	–	–	100	–
	n	–	–	–	–	–	–	–	–	1	–
81–90	%	–	–	–	–	–	–	–	–	–	–
	n	–	–	–	–	–	–	–	–	–	–
91–100	%	–	–	–	–	–	–	–	–	–	–
	n	–	–	–	–	–	–	–	–	–	–

Table 2. Subjects characteristic with inhalation injury

		TBSA									
Age		0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100
With inhalation injury											
0–10	%	–	–	–	100	–	–	–	–	–	–
	n	–	–	–	2	–	–	–	–	–	–
11–20	%	–	0	–	100	–	100	–	–	–	100
	n	–	1	–	1	–	1	–	–	–	1
21–30	%	–	–	100	–	100	100	–	100	100	100
	n	–	–	1	–	2	2	–	2	1	1
31–40	%	–	0	50	100	100	100	100	100	100	–
	n	–	1	2	3	1	4	2	1	2	–
41–50	%	–	–	–	100	100	100	100	100	100	–
	n	–	–	–	2	3	2	1	2	1	–
51–60	%	–	–	100	–	100	100	–	100	–	100
	n	–	–	1	–	1	1	–	1	–	1
61–70	%	–	–	–	–	–	–	–	–	–	–
	n	–	–	–	–	–	–	–	–	–	–
71–80	%	–	–	–	–	–	–	–	–	–	–
	n	–	–	–	–	–	–	–	–	–	–
81–90	%	–	–	–	–	–	–	–	–	–	–
	n	–	–	–	–	–	–	–	–	–	–
91–100	%	–	–	–	–	–	–	–	–	–	–
	n	–	–	–	–	–	–	–	–	–	–

Discussion

The number of subjects included in the study (234 subjects) is much smaller than study of Osler et al, 2010 including 39.888 subjects who delivered revised Baux score with its nomogram as the outcome of their statistical analysis. However, to provide a validation test of such a scoring system, is enough to such an analysis. The estimation of the minimal subject to be enrolled was carried out with multiplying the variables to ten to set the outcome (mortality), then multiply with the estimate proportion of mortality in the unit. Thus, a minimal of 100 subjects was required. These 234 subjects enrolled are distributed in age group, burned area involved, and existence of inhalation injury.

Statistical analysis using Hosmer and Lemeshow test showed that such a scoring system has a good accuracy to be applied in our center. The performance of discrimination of r-Baux score showed the area under curve showing a strong category with the sensitivity 77.9% and specificity 76.9%.

Revised Baux score implementing the variables that simples and easy to find, then the medical personnel in emergency department or in burn unit will have a simplicity to use it as a predictor and or prognostic factor. The calibration showed that such a scoring system will be very helpful for surgeon to predict the mortality accurately. He/she also could decide quick and precisely of what intervention should be made. And certainly, he/she will have enough objective information to be delivered to the patient and or his/her family about the condition.

In addition, a good calibration lead to a possibility of this scoring system to be used for research purpose, for instance as a tool for inclusion for those whose prone to risk of mortality in decision making to an accurate intervention. Whilst a good discrimination showing such a scoring has ability to distinguish who's at that risk, thus sharpening a prediction provided by the scoring system.

Such a score could be used earlier in emergency department during presentation to stratify burns victims based on the prediction to mortality. Prediction of mortality could be determined directly in the graphic of available nomogram. With this simplicity, a quality of management could be measured objectively for audit purpose.

We do believe that this study of validation is the first time run in Indonesia, particularly in our center that does not reflecting Indonesian universally. However, we concludes that this revised Baux score provide a good performance and likely would provide a merit of its clinical application.

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