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External Validation of Belgian Outcome of Burn Injury Score on Burned Patient In Burn Unit dr. Cipto Mangunkusumo General Hospital

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Abstract

Introduction. The scoring system in burns is a merit in predicting mortality. To date, there's no scoring system used as a standard prognostic tool at Cipto Mangunkusumo General Hospital's Burn Unit. Belgian Outcome of Burn Injury (BOBI) Score, one of the best scoring systems in accordance to systematic review in 2013 was validated externally in a study.
Method. A retrospective cohort study was conducted enrolling all burn patients managed during period of 2012 to 2013 in burn unit of Cipto Mangunkusumo General Hospital. The prediction model of BOBI score (age, total burned surface area, and inhalation injury) were variables to be analyzed statistically. ROC and AUC was analyzed to find out its accurate level of prediction. The strong AUC is found with the value of >80–90%.
Results. Out of 304 subjects enrolled, the mean age was 28 years, mean TBSA was 29%, inhalation injury was 15.7%, and overall mortality was 17.7%. The model gave an accurate prediction of mortality. The receiver operating characteristic analysis demonstrated an area under the curve of 0.96 (95% CI 0.94–0.99).
Conclusion. The mortality prediction model (BOBI score) demonstrated a good accuracy. This model provide a good prediction tool and could be implemented in our burn management.

Keywords: *Mortality, prognostic, burn*

Introduction

Burn mortality remains high particularly in the developing countries,[1,2] and in the last century more than 40 prediction models have been proposed and validated. The prediction model is valuable in the assessment of burn prognosis.[3] Thus, further step in management which is structured, effective and efficient might be planned out. The model valued is not just for individual purposed but also in mass casualty for a better intensive treatment. Nevertheless, such a model were practical for auditing purpose in the accrediting the quality of burn unit.[4–6]

This study is addressed to conduct an external validation of prediction model published in 2009, namely Belgian Outcome of Burn Injury (BOBI) score. The prediction model referred to the best in accordance to a systematic review published in 2013. According to this review, the BOBI Score met the all criteria in statistic methodology with good validation. The advantage is of a simple use, that no electronic calculation is required.[4] This scoring system referred to the recently published that suit for burn management to date. Sheppard et al compared such a score to Abbreviated Burn Severity Index (ABSI) and Ryan score, his study showed that BOBI score demonstrated the most accurate prediction. Brusselaers et al in Ghana who also compared BOBI score to Bull, ABSI, Ryan, and Revised Baux score, found that such a score showed the highest discriminating level. In Hungary, validation conducted resulted in a conclusion that BOBI score found to be the best in predicting burn mortality rate.[5]

However, Indonesia is a developing country characterized with demographic and health care system different to those where the score formulated. Thus, the score should be validated to be generalized in the country. Indeed, to date in burn unit of dr. Cipto Mangunkusumo General Hospital there were no standard scoring system used. It was hypothesized that BOBI score would show high accuracy on the validation, thus could be implemented in burn unit of dr. Cipto Mangunkusumo General Hospital.

Method

A retrospective cohort study was conducted enrolling all burned patient (total sampling method) admitted in burn unit in period of January 2012 to December 2013. Those with insufficient data were excluded. Variables of predictor (age, total burned surface area, inhalation injury) were analyzed to mortality using bivariate analysis. Accuracy of BOBI score were evaluated using value of discrimination equation with receiver operating curve. Such a value were analyzing the area under the curve, while as the calibration is analyze using Hosmer and Lemeshow method. The strong AUC is found with value of >80–90%.

The study approved by Ethical Committee of Research in the Faculty of Medicine, Universitas Indonesia (Ethical Clearance No. 185/H2.F1/ETIK/2014) and Research bureau of dr. Cipto Mangunkusumo General Hospital (No. LB.02.01/X.2/228/IV/2014).

Table 1. Belgian outcome of burn injury score

	0	1	2	3	4
Age (years)	<50	50–64	65–79	>80	
TBSA (%)	<20	20–39	40–59	60–79	>80
Inhalation injury	No			Yes	

Total score											
	0	1	2	3	4	5	6	7	8	9	10
Mortality prediction	0.1	1.5	5	10	20	30	50	75	85	95	99

Results

In period of 2012–2013, out of 304 patients managed there were 248 subjects enrolled consist of children of <15 years old (28.6%) and 177 adults (71.4%). Of total population, mean age is 30 years old (IQR: 9–41 years), mean TBSA is 28.7% (IQR: 14–37.25%). Inhalation injury found in 39 subjects (15.7%). Male of 167 subjects (67.3%) and female 81 subjects (32.7%). Complete subjects' characteristic is described in table 2.

In such a period, there were 44 subjects (17.7%) died, consist of 20 (45.5%) female and 24 (54.5%) male subjects. Out of total 81 females, there were 24.7 % died, whilst in male we found 14.4% out of 167 died. Those who died under 50 years were 17.11% whilst >50 years were 23%. In pediatric, out of 71 total population there were 11 subjects (15.5%) died. Those with TBSA <20% the mortality is 2.2%, 14.4% in TBSA of 20–49% and 75.8% in TBSA of >50%. Those with inhalation injury showed the highest mortality rate which is 89.7%. However, in the analysis, correlation between the ages with mortality showed p 0.778, and TBSA showed correlation to mortality with p <0.001), so does inhalation injury (p <0.001)(table 3).

Table 2. Prevalence of ages, TBSA, inhalation injury, and mortality

	Total n=248	Male n=167	Female n=81	p
Ages (yo), mean (IQR)	28 (7.3–40)	28 (10–39)	28 (4–45)	0.952
TBSA (%), mean (IQR)	29 (14–37.3)	29.5 (15–37)	27.1 (11,8–37,8)	0.34
Inhalation injury, n (%)	39 (15.7)	19 (11.4)	20 (24.7)	0.009
Mortality (%)	44 (17.7)	24 (14.4)	20 (24.7)	0.049

IQR, interquartile range, % in each gender group

Out of 34 total predicted death, there were 44 death have been observed. There were just 21 subjects predicted to death of 50% and more, and out of 18 died (just 13 who was predicted). There was just 1 subject with total score more than 8. This prediction demonstrated underestimation with ratio (observed/predicted =1.29); as seen in table 4.

Table 2. Correlation between ages, TBSA, inhalation injury, and mortality

	Total	Died	Survive	p
Age				0.432
0–49 yo	223	39 (17.5%)	184 (82.5%)	
50–64 yo*	22	5 (22.7%)	17 (77.3%)	
≥65 yo*	4	1 (25%)	3 (75%)	
TBSA				< 0.001
<20%*	98	2 (2%)	96 (98%)	
20–39%*	101	14 (13.9%)	87 (86.1%)	
40–59%**	26	11 (42.3%)	15 (57.7%)	
≥60%**	24	18 (75%)	6 (25%)	
Inhalation injury				< 0.001
Yes	39	35 (89.7%)	4 (10.3%)	
No	209	9 (4.3%)	200 (95.7%)	

Analysis of ROC demonstrated the area under the curve (AUC) of 0.964 (95% CI: 0.935–0.992) as seen in fig. Accuracy of the score was also analyzed the variable of gender separately. AUC found higher in male (0.986, 95% CI 0.971–1) than female (0.94, 95% CI 0.88–0.994).

In pediatric, such a score showed accuracy of prediction, though further analysis is required enrolling larger samples (AUC 0.955, 95% CI 0.889–1). The goodness of fit (all samples) using Hosmer–Lemeshow showed calibration of 7.392; p 0.06.

Discussion

Scoring systems in burns were varies in times journey. Paralleled to the progress there were three essential variables were almost included, namely ages, TBSA, and inhalation injury. A prime scoring system shall always follow the development of recent standard care and epidemiologically factual. The use of former scoring system such as Baux Score, Burn Injury Severity Score etc., were suited to their days as there are significant difference to the problem and recent burn management.

As there were many scoring systems available, a systematic review is then conducted and published in 2013, where the scoring system were evaluated in accordance to statistic methodology as well as the validity. BOBI score referred to a new generation of scoring system that met the criteria.

The advantage of BOBI score was in its quality that met the criteria of a standard scoring system according to systematic review. In addition, the simplicity of the usage is an important issue to be considered. Should it compare to recent score (Revised Baux Score) which is a revision of former Baux score, both of score use the ages, TBSA, and inhalation injury as variables. The BOBI scoring system showed to be superior since there were no nomogram to be used, but a simple table to be remembered. Besides, Revised Baux Score did not meet all the criteria of standard statistic methodology according to a systematic review.

In the study, we showed the prime of BOBI score showed a strong prediction in pediatric population (AUC 0.955) whereas not shown in Revised Baux Score. For this reason, a new scoring system is then formulated and specially addressed to pediatric population, namely Pediatric Baux Score. It's meant to lift the prediction accuracy in pediatric population using basic formula of Baux score. Yet, the disadvantage in this scoring system it noted in the variable of inhalation injury which diagnosed using the gold standard procedure of bronchoscopy which is routinely implemented to date.

The use of BOBI score in mortality analysis.

Overall mortality in burn unit of Cipto Mangunkusumo General Hospital is 17.7%. It is found quite high compare to mortality rate in Belgium where the score is developed (4.3%). The difference of emergency medical system and socio–economic background were the reasonably issues. Inhalation injury referred to the most important issues leading to burn mortality. We found the prevalence of 15.7% to be higher than in Belgium of 9.4%. TBSA also showed difference i.e. 29% in Cipto Mangunkusumo General Hospital compare to 11.4% in Belgium.47 Should we look to the ages, we found it no difference i.e. 28 years old compare to 34 years old in Belgium.

Though there were differences, it seems that such a scoring system showed accuracy with mortality ratio of observed/predicted in total population of 1.29. Such a score showed a high discriminative power

in total population (AUC 0.955), ages, gender, and pediatric as illustrated in ROC (fig.1). Calibration using The Goodness of fit Hosmer–Lemeshow showed a fair result (p >0.05) with p value of 0.06.

The limitation of a study was the distribution of specific group ages which is found abnormal. The other is, we conduct it retrospectively, though even there is a question should a prospective study will improve the outcome, since in the unit we hold the principle to provide maximal treatment; whatever the condition is. Thus, a prognostic tool will not change the clinical judgment.

Conclusion

With a high accuracy, in addition to its simplicity, BOBI score is recommended to be used as a predicted of prognosis in burn unit of Cipto Mangunkusumo General Hospital.

Conflict of interest

Author disclose no conflict of interest.

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