Modified TRISS:

.

Abstract

Modified TRISS: A More Accurate Predictor of In-hospital Mortality of Patients with Blunt Head and Neck Trauma

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Purpose: Recently, The new Injury Severity Score (NISS) has become a more accurate predictor of mortality than the traditional Injury Severity Score (ISS) in the trauma population. Trauma Score Injury Severity Score (TRISS) method, regarded as the gold standard for mortality prediction in trauma patients, still contains the ISS as an essential factor within its formula. The purpose of this study was to determine whether a simple modification of the TRISS by replacing the ISS with the NISS would improve the prediction of in-hospital mortality in a trauma population with blunt head and neck trauma.

Objects and Methods: The study population consisted of 641 patients from a regional emergency medical center in Kyoungsangnam-do. Demographic data, clinical information, the final diagnosis, and the outcome for each patient were collected in a retrospective manner. the ISS, NISS, TRISS, and modified TRISS were calculated for each patients. The discrimination and the calibration of the ISS, NISS, modified TRISS and conventional TRISS models were compared using receiver operator characteristic (ROC) curves, areas under the ROC curve (AUC) and Hosmer-Lemeshow statistics.

Results: The AUC of the ISS, NISS, modified TRISS, and conventional TRISS were 0.885, 0.941, 0.971, and 0.918 respectively. Statistical differences were found between the ISS and the NISS (p=0.008) and between the modified TRISS and the conventional TRISS (p=0.009). Hosmer-Lemeshow chi square values were 13.2, 2.3, 50.1, and 13.8, respectively; only the conventional TRISS failed to achieve the level of and an excellent calibration model (p<0.001).

Conclusion: The modified TRISS is a more accurate predictor of in-hospital mortality than the conventional TRISS in a trauma population of blunt head and neck trauma.

Key Words: Trauma, Trauma score injury severity score, New injury severity score, Mortality

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RTS (revised trauma score)

　　Injury Severity Score (ISS) New Injury Severity Score (NISS)，　　　　RTS ISS　　　　　　　　　　　　　Trauma Score Injury Severity Score (TRISS) (1-4)．RTS　　　　　　　　　，　　　　，
Glasgow Coma Scale(GCS)　　　　0　　4
　　　　　，0　　7. 8408
　　　　　　　　　　．ISS
　　6　　　　　　　　，
1　　6　　　　　　　　　　Abbreviated Injury Scale (AIS)　　　，
　　AIS　　　　　　　3
　　　　　　　　1~ 75
　　　　　　　．NISS　AIS　　，
　　　3
，　　ISS
　　　　　．TRISS　RTS, ISS
　　　（　　　　　　　　）

　　．　　AIS
　　　　　　　　　，
AIS
　　　　　　　　　　．

　　　　NISS
　　　　　　　，
　　　　　　　　．
　　　　　　　，
　　RTS
　　　　　　TRISS

　TRISS　ISS　NISS　　　modified TRISS　　　　　ISS, NISS, TRISS
　　　　．

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2003　1　1　　　2004　12　13
　　　　　　8424
．　，　　　　　　(DOA)

，　　　　　RTS
，　　　　　　641
．
，　，
，
，　　　RTS, ISS, NISS, TRISS, modified TRISS　．
GCS　　　　AVPU
　Kelly　　　　　A=15, V=13, P=8, U=3　　GCS　　，
　　GCS　"verbal"
，Rutledge
"estimated GCS verbal" (5, 6)．

Estimated GCS Verbal=(2. 3976)+[GCS Motor X (-0. 9253)]+[GCS Eye X (-0. 9214)]+[(GCS Motor) sup 2 X (0. 2208)]+[(GCS Eye) 2 X (0. 2318)].
GCS
RTS　　　　．modified TRISS
TRISS　　ISS　　NISS
，　　　TRISS modified TRISS　　　　　1-TRISS, 1-(modified TRISS)　　　．
Hosmer-Lemeshow chi square　　　，
，ISS, NISS, 1-TRISS, 1-(modified TRISS)　　，
Hosmer-Lemeshow chi square　　p-value
．ISS, NISS　Cope　　cutoff
，　　ISS　NISS
．TRISS　modified TRISS
1~ 10, 11~ 20, 21~ 30, 31~ 40, 41~ 50, 51~ 60, 61~ 70, 71~ 80, 81~ 90, 91~ 100　10
．ISS, NISS, 1-TRISS, 1-(modified TRISS)　　，　，　　（
，　　　，　），
t-test, chi square　，
ANOVA　　．
ISS, NISS, 1-TRISS, 1-(modified TRISS)　ROC
，　，cutoff　，ROC
(AUC, area under ROC curve)
．　SPSS (version 12. 0)　　．

— : Modified TRISS: —

. , (Table 1).

NISS, 1-

641 , 453 (70. 7%), TRISS , 66 16

188 (29. 3%) 2. 42: 1, 41. 8± NISS , 66

21. 8 . (61. 8%), 1-TRISS .

(24. 8%), (13. 4%) . ISS, NISS, 1-

16 14. 2%, 16~ 65 69. 9%, 66 TRISS, 1-(modified TRISS)

15. 9% . (Table 2).

, , , ISS NISS 13. 8± 8. 3, 18. 5± 12. 1 ,

6. 3% ,

Table 1. Description of study population

Group	No. case(%)	Death	p-value
All	641	40 (6.3)	
Sex			
Male	453 (70.7)	29 (6.4)	0.793
Female	188 (29.3)	11 (5.9)	
Age (41.8± 21.8)			
< 16 yr	91 (14.2)	1 (1.1)	
16-65 yr	448 (69.9)	30 (6.7)	0.066
> 65 yr	102 (15.9)	2 (8.8)	
Mechanism			
MVA*	396 (61.8)	27 (6.8)	
Fall/slip	159 (24.8)	10 (6.3)	0.512
Others[†]	86 (13.4)	3 (3.5)	
Associated injury			
Yes	301 (47.0)	19 (6.3)	0.943
No	340 (53.0)	21 (6.2)	

* Motor vehicle accident

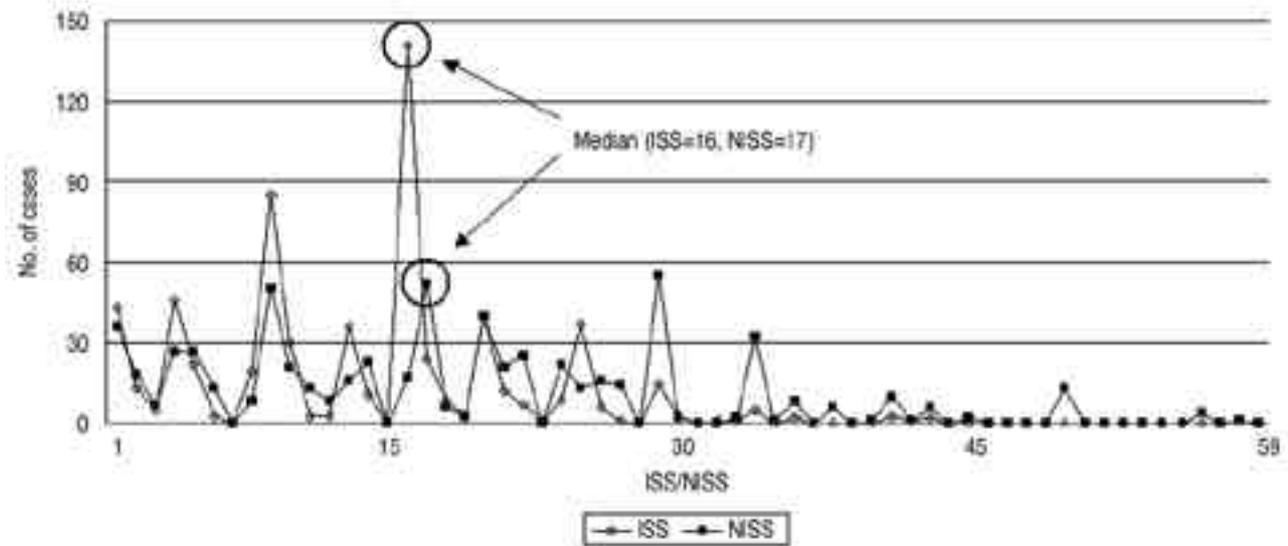[†] Others included other blunt (N=76, death=2), machinery (N=2), unknown (N=8, death=1)

Fig. 1. Distribution of ISS ( ) and NISS ( ).

16 17 (Fig. 1). NISS=ISS 47 (7.3%), TRISS
237 (37.0%), NISS>ISS, ISS>NISS 41 (6.4%) .
399 (62.2%), 5 (0.8%) (Table 1, Fig. 2). , ISS, NISS, 1-TRISS,
Table 3 ISS NISS . 1-(modified TRISS) ,
Table 4 TRISS modified TRISS Hosmer-Lemeshow 13.1, 2.3,
. TRISS modified TRISS 51.4, 15.9 , p 0.11, 0.97, <0.001,
553 (86.3%), Modified TRISS 0.043 ISS NISS

Table 2. ISS, NISS, TRISS and modified TRISS according to subgroups

Group	ISS	NISS	(1-TRISS) x100	(1-mTRISS) x100
All	13.8± 8.3	18.5± 12.1	5.0± 10.4	5.2± 12.3
Sex				
Male	14.1± 8.2	19.0± 12.2	5.0± 10.0	5.4± 12.0
Female	12.9± 8.5	17.1± 11.8	5.1± 11.4	4.7± 12.8
Age (41.8± 21.8)				
< 16 yr	12.5± 7.1	16.5± 10.7†	1.8± 3.3†	3.4± 8.0
16-65 yr	13.7± 8.6	18.3± 12.2	4.5± 10.3†	5.3± 12.9
> 65 yr	15.3± 7.7	21.1± 12.6*	10.2± 13.2*	6.4± 12.5
Mechanism				
MVA*	14.3± 8.9*	19.1± 12.6*	5.7± 11.1	6.0± 13.0
Fall/slip	14.2± 7.4*	19.3± 11.8*	4.5± 8.5	4.5± 11.3
Others	10.9± 6.2†	13.7± 9.2†	3.0± 10.5	3.0± 10.2
Associated injury				
yes	16.2± 8.8*	20.1± 11.6*	6.6± 13.1*	6.3± 14.1*
no	11.6± 7.1	17.0± 12.4	3.6± 7.0	4.2± 10.3

* p-value < 0.05 vs. † .

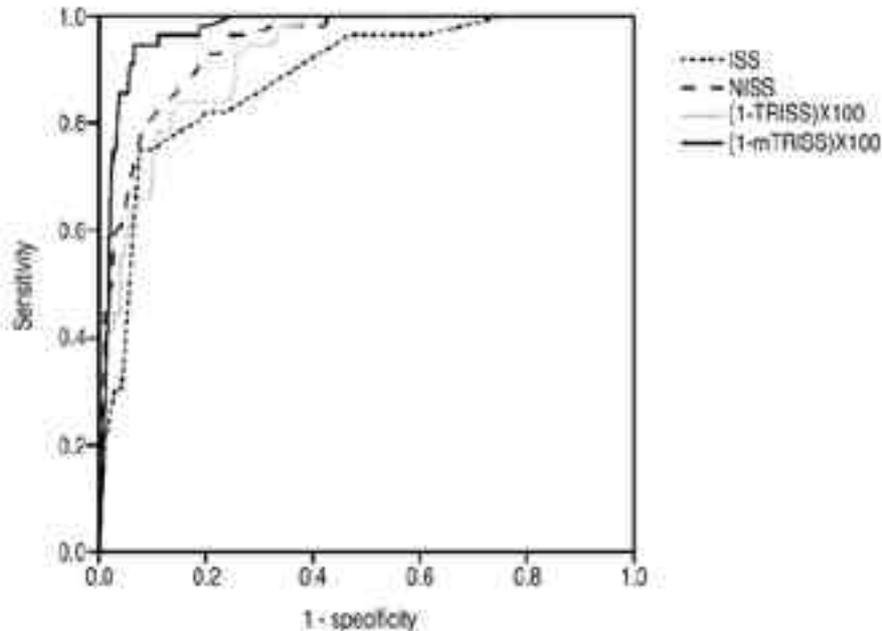**Fig. 2.** Receiver operating characteristic of ISS, NISS, 1-TRISS and 1-(modified TRISS).

1-TRISS, 1-(modified TRISS)
(Table 5).

Fig. 2　　　　　　　　　　　　　　 ISS, NISS, 1-
TRISS, 1-(modified TRISS)　 ROC

.　　　　　　　　　　　　　　　 ,

ISS　 85.0%, 81.5%(cutoff =19), NISS
92.5%, 82.2%(cutoff =28), 1-TRISS　 90.0%,
75.0%(cutoff =4.52), 1-(modified TRISS)

97.5%, 93.9%, (cutoff =9.1)　　. AUC　 1-
(modified TRISS)(0.976), NISS(0.950), ISS(0.911),
1-TRISS(0.904)　　　 (Table 5, Fig. 2).

.

1974　 Baker　　　　　　　　 Injury Severity
Score (ISS)　　　　　　　　　　　　 gold stan-

Table 3. Distribution of ISS and NISS categories

ISS	NISS							
	1-8	9-15	16-24	25-40	41-49	50-66	75	Total
1-8	136	15						151
9-15		116	44	8				168
16-24			142	99	4			245
25-40				44	12	14		70
41-49					3	3		6
50-66						1		1
75								0
Total	136	129	186	151	19	18	0	641

Table 4. Distribution of TRISS and modified -TRISS categories

TRISS	Modified -TRISS										
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	
0-10	543	15	5		5						568
11-20	25	5	4	3	2		2				41
21-30	4	3	3	2	1						13
31-40		1			2		1		1		5
41-50					1						1
51-60		2	2	1	1			1			7
61-70			1					1	1		3
71-80										1	1
81-90											0
91-100									1	1	2
Total	572	26	15	6	12	0	3	2	3	2	641

Table 5. Comparison of ISS, NISS, TRISS and modified TRISS

	Discrimination		Calibration	
	AUC* (95% CI)	p-value	H-L[†]	p-value
ISS	0.911 (0.873-0.948)	<0.001	13.1	0.11
NISS	0.950 (0.923-0.977)	<0.001	2.3	0.97
(1-TRISS) x100	0.904 (0.867-0.940)	<0.001	51.4	<0.001
(1-mTRISS) x100	0.976 (0.962-0.990)	<0.001	15.9	0.043

* Area under ROC curve, [†] Hosmer-Lemeshow chi square.

dard (1). , ISS
, NISS ISS

. ISS , NISS ISS

. ISS (9).

, AIS (Abbreviated NISS ISS ,

Injury Scale) TRISS ISS NISS

,

. . ISS NISS

. , NISS ,

, Hosmer-Lemeshow NISS

(HL , 2.3 vs. 13.1).

, , AIS TRISS modified TRISS HL

ICD , 50.1(p<0.001), 15.9(p=0.043)

. modified TRISS TRISS

. Modified

Trauma Score, Revised Trauma Score TRISS TRISS HL

SIRS (Systemic Inflammatory Response ,

Syndrome) Physiologic TRISS modified TRISS

Trauma Score (3, 7, 8). 1987 , . , TRISS

Boyd ,

, AIS Osler TRISS

, Trauma Score ,

, TRISS(Trauma Score- ROC

Injury Severity Score) (4). TRISS

ISS NISS(New Injury (12).

Severity Score)

, Osler

(2, 9). Osler 1996

, AIS .

International Classification of Disease-9

ICISS (ICD-9 based injury severity score) . , NISS ISS

ISS ,

(10). .

Glasgow Coma Scale(GCS) . .

. RTS , , GCS

1989 Champion modified TRISS TRISS .

Trauma Score

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