Chest Gunshot Injury Severity Score: Model Specification And Diagnostic Accuracy Using the National Trauma Data Bank

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INTRODUCTION

- Gunshot injuries to the chest is a major cause of trauma-related mortality, requiring rapid and accurate risk assessment.
- Existing trauma scoring systems have limitations in predicting outcomes specific to chest gunshot injuries, often lacking comprehensive integration of key prognostic factors.
- The Chest Gunshot Injury Severity (CGIS) score addresses these gaps by incorporating sociodemographic, anatomical, physiological, and clinical parameters for improved risk stratification.
- Validating CGIS in trauma care settings can enhance its clinical utility, guiding treatment decisions and improving patient outcomes.

PURPOSE

- To develop the CGIS score using key predictors of mortality
- To evaluate the diagnostic accuracy of the CGIS score
- To compare the CGIS with other available injury scoring tools

METHODS

- Data Source: 2020 Trauma Quality Improvement Data from the National Trauma Data Bank
- Inclusion and Exclusion Criteria: Chest gunshot injuries selected using ICD-10 E-codes and Procedure Coding System.
- Sample Size: A total of 18,630 patients with gunshot injuries involving the chest was split into training (n=13,051) and test (n=5,579) sets in a 70:30 ratio for model validation and ROC analysis, respectively.
- Outcome Variables:
  - Model Validation: Time to Death
  - ROC Analysis: Mortality (Dead vs. Alive)
- Predictor Variables:
  - Model Validation: Sociodemographic, Injury Mechanism, Severity, and Characteristics, Place of Injury, Transport Type, and Trauma Center Level
  - ROC Analysis: CGIS Score, Injury Severity Score (ISS), Trauma and Injury Severity Score (TRISS)
- Model Development: Final model selected using LASSO regression, assessment of Variance Inflation Factor, Autocorrelation, and Proportional Hazard Assumption
- CGIS Scoring Weight: Significant variables with risk ratio less than 1.2 excluded. Scores of 1 and 2 assigned to risk ratios of ≥1.2 to <1.5 and ≥1.5 and <2.5
- ROC Analysis: Area under the ROC curve computed and CGIS compared to ISS and TRISS using DeLong's test.

Using the training data, we created the Chest Gunshot Injury Severity (CGIS) Score using 11 of 23 highly significant predictors of mortality

Using the test data, the CGIS Score exhibited 97% (AUC 96.7; 95% CI: 96.2–97.2) accuracy in predicting in-hospital mortality, comparable to the TRISS Score

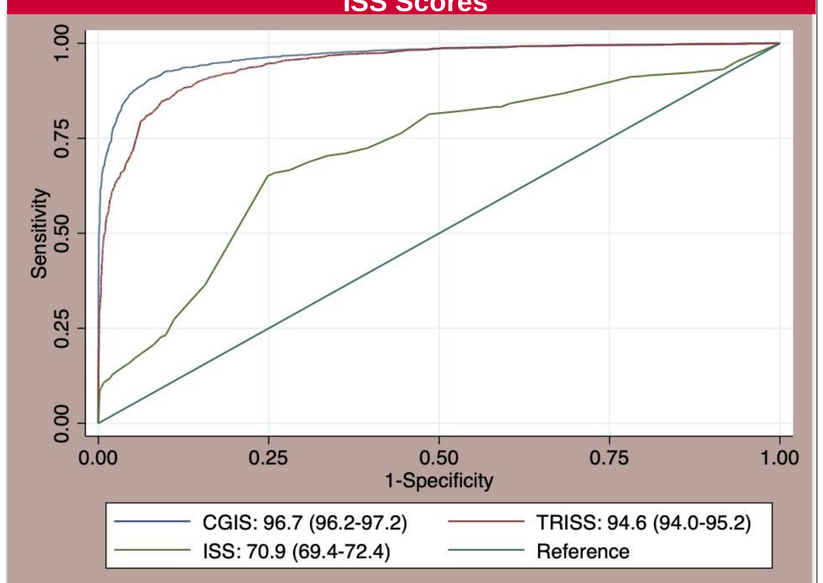
The CGIS score risk-stratifies, in a step-wise pattern, clinical care trajectory in likelihood of ICU admission, emergency room deaths, and transfer to the operating room

RESULTS

Summary of Variables In The Chest Gunshot Injury Score

Variable	Adjusted HR	CGIS Weight
Older Adult	1.40 (1.16 – 1.68)	+1
Unscreened Alcohol Use	1.74 (1.59 – 1.91)	+2
Self-Pay	1.38 (1.28 – 1.49)	+1
Self-Harm	1.74 (1.58 – 1.92)	+2
Interfacility Transfer	0.45 (0.37 – 0.54)	-2
Air EMS Transport	0.69 (0.59 – 0.81)	-1
ISS >12	1.74 (1.60 – 1.89)	+2
RTS <4	4.42 (4.08 – 4.79)	-4
Head Injury	0.66 (0.59 – 0.74)	-1
Chronic Disease (1 or more)	0.61 (0.54 – 0.70)	-1
Supplemental Oxygen	2.23 (2.01 – 2.47)	+2

Comparison of the Accuracy Between CGIS, TRISS and ISS Scores



Risk Stratification of the Chest Gunshot Injury Score

Risk Categories	Died in ED	OR from ED	ICU Admission
Low Risk	Ref	Ref	Ref
Moderate Risk	9.54 (5.71 – 15.93)	1.45 (1.27 – 1.65)	1.74 (1.50 – 2.02)
High Risk	209.80 (130.06 – 338.45)	0.33 (0.29 – 0.39)	0.24 (0.21 – 0.28)
Severe Risk	569.13 (330.77 – 979.26)	0.19 (0.14 – 0.26)	0.05 (0.03 – 0.08)

DISCUSSION

- The CGIS score provides a standardized approach to mortality risk stratification
- The CGIS compares effectively with the TRISS while providing opportunity to assess social determinants of health that may influence survival.
- The CGIS can effectively risk stratify and aids in triage and rapid decision-making for trauma teams and emergency responders.
- CGIS score can guide resource allocation in prehospital and hospital settings.
- Its high accuracy supports its use in quality improvement initiatives and may

CONCLUSION

- The CGIS score is a highly predictive tool for stratifying mortality risk in chest-related gunshot injuries.
- It can support quality improvement efforts by guiding resource allocation and enhancing prehospital and emergency care for these injuries.

REFERENCES

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