VALIDATION OF A NEW CLASSIFICATION TO PREDICT MORTALITY IN PENETRATING CARDIAC TRAUMA USING ARTIFICIAL INTELLIGENCE: THE BOGOTA CLASSIFICATION

María Isabella Zúñiga Velásquez[1], Luis Felipe Cabrera Vargas[2], Luis Eduardo Pino Villarreal, Nicole Wagner Gutierrez

1. Faculty of Medicine, Universidad El Bosque. Research Group in General Surgery and Subspecialties
2. Fundación Santa Fe de Bogotá, Bogotá, Colombia
3. School of Medicine, Universidad de los Andes, Bogotá, Colombia

Introduction

Penetrating chest trauma (PCT) represents 10% of worldwide mortality, with countries such as Colombia counting as some of the most affected by high mortality rates due to its high violence prevalence. **Three distinct machine learning models** were employed to analyze their performance in **predicting outcomes in cases of precordial wounds** between the Bogotá Classification and the Ivatury Scale.

Ivatury Scale

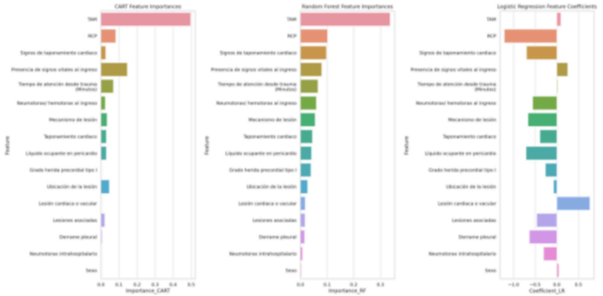
Hemodynamic Status	Description
Dead	No vital signs at the scene or upon arrival at the emergency room.
Fatal	Vital signs present at the scene but absent upon admission to the emergency department.
Deep Agonizing	Pupillary reactivity or respiratory effort present upon admission, but with nonpalpable blood pressure or loss of vital signs in the resuscitation room.
Shock	Brachial systolic blood pressure critically low.

Methods:

A retrospective cohort study was conducted, comprising 501 patients with precordial wounds collected from Hospital Cardiovascular del Niño de Cundinamarca institutions in Bogotá during 2018-2021. Three predictive machine learning (ML) models were then trained to identify predictor variables for hemodynamic instability. **The developed models included logistic regression (LR), decision tree for regression CART, and random forest (RF).** A concordance analysis was conducted using Cohen's Kappa index to **compare** the proprietary **scale** used in **Bogotá** with the validated **Ivatury scale.**

Results:

The model with the best final **sensitivity** was **CART** with a performance of **98.67%**, followed by **RF** with **95.33%,** and **LR** with **92%**, demonstrating that **all three are generalizable models.**



After filtering out anomalies, we calculated a Cohen's Kappa score of 0.860 based on 497 observations, indicating a **strong agreement** between **our classification system** and **Ivatury's**. This substantial level of consistency underscores the **reliability** and **alignment** of both systems in categorizing the data.

Conclusions:

The incorporation of machine learning models not only contributes to improving healthcare outcomes in Colombia but also holds promise for informing clinical practices and policy decisions in diverse settings worldwide.

The Bogotá Classification for Penetrating Cardiac Trauma

Grade	Patient Presentation	Management
I	Stable (absence of hypotension [SP > 90 - MBP > 65]), absence of cardiac tamponade signs	Chest X-ray and pericardium ultrasound with FAST protocol or subxiphoid/transthoracic pericardial window
II	Unstable (hypotension that does not improve with fluid therapy—1 L of crystalloid—and/or cardiac tamponade)	- Left anterolateral thoracotomy → if the wound is on the left - Sternotomy → if the wound is on the right or is parasternal
III A	Unstable with cardiac tamponade signs, vital signs when admitted to the emergency department, and a present witnessed cardiorespiratory arrest	Emergency resuscitative thoracotomy
III B	Unstable with cardiac tamponade signs and a witnessed cardiorespiratory arrest during primary transfer	Emergency resuscitative thoracotomy
III C	Without vital signs since the beginning of prehospital care	Necropsy

Abbreviations: FAST, focused assessment with sonography in trauma; MBP, mean blood pressure; SP, systolic pressure.

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