USE OF A MACHINE LEARNING ALGORITHM TO PREDICT REBLEEDING AND MORTALITY FOR ESOPHAGEAL VARICEAL BLEEDING IN CIRRHOTIC PATIENTS

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OTIMIZAQUANT

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INTRODUÇÃO / OBJETIVO

Esophageal variceal bleeding (EVB) is one of the most common complications of cirrhosis. Its mortality rates range around 15%-20% in the first episode. Given EVBs high rates, identifying patients with a high chance to survive is paramount in order to allocate resources into treatment with accuracy.

The purpose of this study is to use a machine learning algorithm to predict rebleeding and mortality for EVB in cirrhotic patients and to analyze its accuracy.

EXPERIMENTAL

A historical cohort study was conducted, analyzing data from hospital charts from Jan 2010 to Dec 2016. Patients were found by searching every use of terlipresin in the period. Paper and electronic medical charts were hand-analyzed.Patients over 18 years old with laboratory and imaging data supporting the diagnosis of cirrhosis and with a definitive diagnosis of EVB were included. This analysis used data from 74 cirrhotic patients, taking into account 36 variables, which had EVB as a complication. The preliminary analysis of the study was Pearson Correlation, which compared the 36 variables in study with the outcomes of death and rebleeding. This was in order to verify the linear correlation strength, positive or negative. When Artificial Intelligence (AI) was applied, an Artificial Neural Network (ANN) was utilized to recognize patterns of the outcomes through supervised learning. The results were analyzed based on a confusion matrix, which presented the probabilities of the Positive Predictive Value, Negative Predictive Value, Sensitivity, Specificity and Network Accuracy. A Receiver Operating Characteristic (ROC) curve analysis was then performed.

RESULTADOS E DISCUSSÃO

Electronic search retrieved 177 hospital admissions with use of terlipresin. 101 were due to EVB. All- cause mortality was 36%, 41.5% and 50.4% for 30-, 90- and 365-day, respectively. Mean age was 56 years-old, 79% were male. Most common cause of cirrhosis was alcohol abuse, followed by hepatitis C.

The Pearson Correlation analysis showed the variables have values of linear correlation ranging from -0.34 to 0.30 to mortality and -0.31 to 0.21 to rebleeding. Both values represent weak correlations with the outcomes. Thus, it is notably difficult to define which variables are the ones with major leverage on the outcomes. Ergo, the use of AI could be a key-tool to identify the patterns in such a complex data-evolved situation.

RESULTADOS E DISCUSSÃO

For patients who had a mortality outcome, the specificity value shows that the ANN was able to identify 95.0% of them. The predictive value shows when the ANN predicted mortality, 95.0% of the patients did indeed perish. The overall accuracy was 97.4% and the Area Under the curve ROC (AUROC) was 0.993, which demonstrates a high performance of the network.

For patients who had a rebleeding outcome, the specificity value shows that the ANN was able to identify 66.7% of them. The predictive value shows when the ANN predicted rebleeding, 100% of the patients did indeed rebleed. The overall accuracy was 97.4% and the AUROC was 0.942.

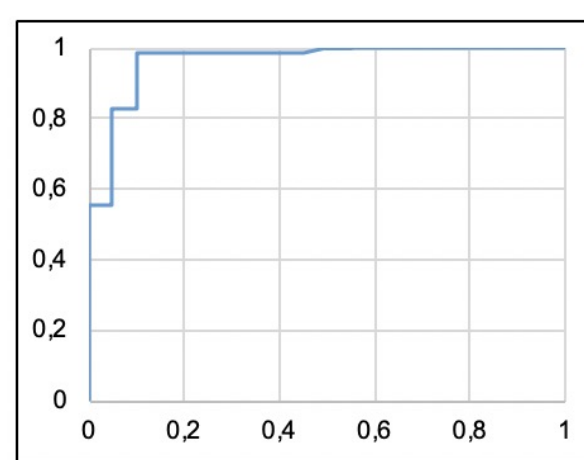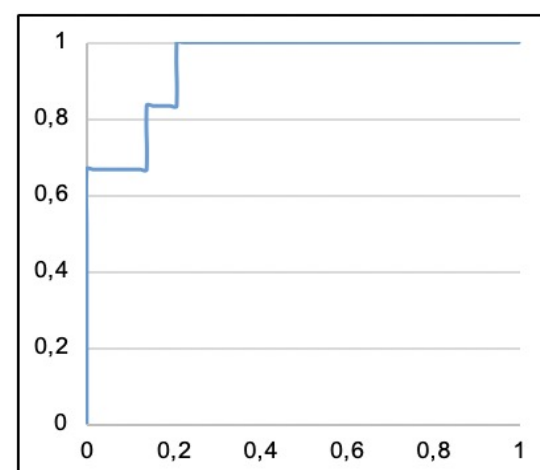Figure 1. ROC Curve for the prediction of mortality

Figure 2. ROC Curve for the predicition of rebleeding

CONCLUSÕES

The ANN could more accurately predict mortality by EVB when compared with two other assessment tools, CLIF-SOFA and MELD Score.The literature has already reported that the CLIF-SOFA has better predictive characteristics than the MELD Score. The AUROC of the CLIF-SOFA found in the literature for the outcome death was 0.943 and the AUROC of the MELD score was 0.80. While, the AUROC of the ANN was 0.993. Therefore, Machine Learning could be a useful tool in order to improve clinical practice, perhaps outperforming the current tools.

REFERÊNCIAS BIBLIOGRÁFICAS

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