Prothrombin time activity percentage, is it relevant?

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IPO COIMBRA

INTRODUCTION

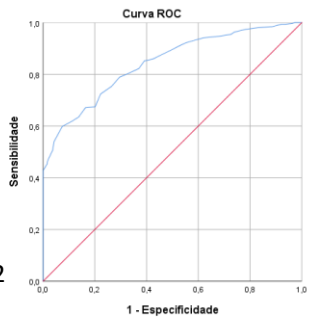
Prothrombin time (PT) is the most common screening coagulation test. The PT assesses the extrinsic and common pathways of coagulation. Results are commonly expressed in seconds (PTs), percentage activity (PTp) and International Normalized Ratio (INR). PTp activity was used widely in Europe and calculated as PTp from normal pooled plasma (NPP). It´s obtained by measuring PT in seconds as 100% in undiluted NPP, 50% when NPP is diluted 1:1 with buffer, 25%, 12.5% and 6.25%. Then PTs is plotted vs PTp of plasma dilution (prothrombin activity). Although the majority of European laboratories are no longer reporting PT in PTp, there are some authors that consider prothrombin activity to be the most reliable test for estimation of liver failure, when compared to INR and PTs. With this in mind, we evaluated PTs, PTp and INR on oncology patients that presented signs of liver failure, in order to understand if we should keep PTp in our results.

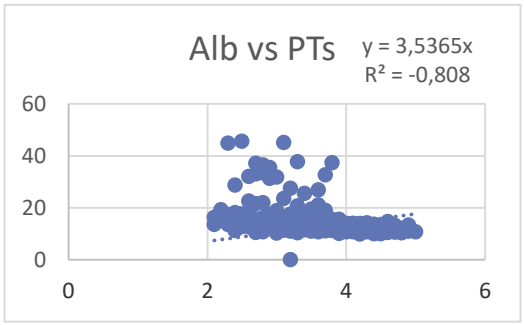
METHODS

A retrospective evaluation of patients presenting results for total protein (TP), albumin (Alb), PTs, PTp and INR was performed for the year 2020 with 9264 patients. Correlation was evaluated by Pearson's correlation. Prediction of liver failure was evaluated by area under the curve (AUC) of receiver operating characteristic curves.

RESULTS

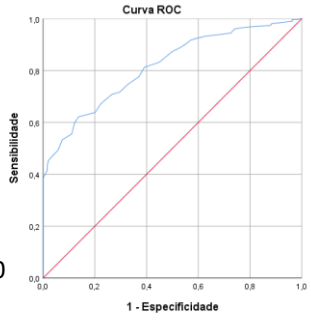
Liver failure
PTs
AUC = 0,842



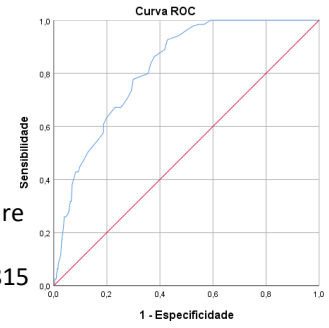


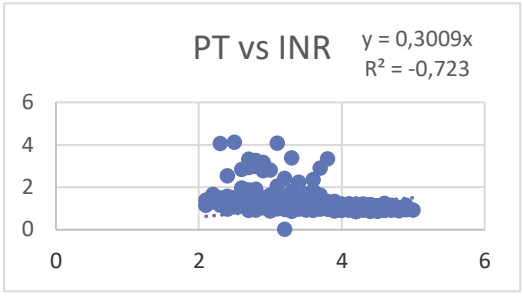
PTs results presented the best correlation with Alb (R2=0,808), whereas INR evidenced the best correlation with TP (R2=0,723). The PTp showed the worst correlation with both Alb and TP, R2=0,343, R2=0,230 respectively. AUC for liver failure was 0,842 with PTs, 0,820 with INR and 0,815 for PTp.

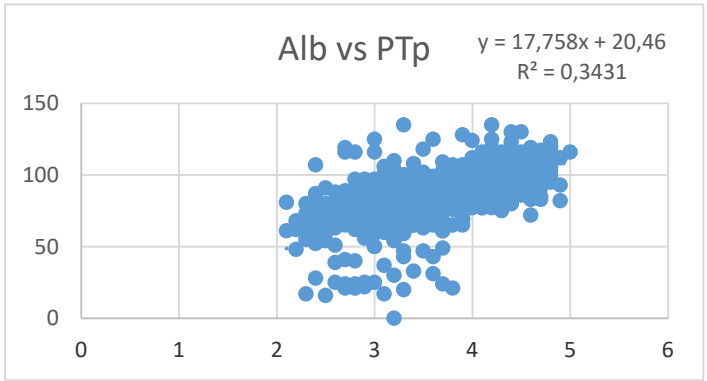
Liver failure
INR
AUC = 0,820

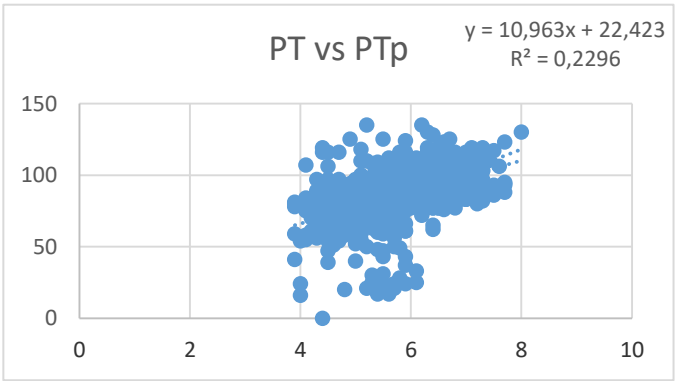


Liver failure
PTp
AUC = 0,815









DISCUSSION

Normal pool plasma in the PT clots approximately within 10-12 seconds upon triggering coagulation. This unit reporting was used at the very beginning. Because clinicians weren't very familiar with such a scale it was decided to express results in terms of percentage activity. The percentage is intuitive and based on the observation that diluting NPP produces percentage activities to decrease while prolonging clotting times. Although intuitive for clinicians, PTp has some limitations. First, the relation between clotting times and percentage activities isn't linear. Second, the slope and intercept of the calibration curve depend on the NPP and the type of diluent used. Third, the hyperbolic shape of the curve, which tends to parallel the axes at low and high dilutions, also makes the percentage activity scarcely responsive to the variation of the clotting times at low percentage activity and excessively responsive at high percentage activity, respectively. Such an effect implies that relatively large clotting time variations in patients on warfarin may translate into relatively small percentage activity variations, thus complicating dose adjustment of patients using these drugs. Conversely, small clotting time variations in healthy subjects translate into large variation of percentage activity, which may occasionally lead to values far higher than 100% that might be erroneously interpreted as an index of hypercoagulability. Therefore, supported by our findings that showed a poor correlation to TP and Alb, with the lowest AUC obtained for liver failure prediction, PTp reporting brings no value to PT evaluation. Our opinion is that this approach should be now abandoned, bringing an economic advantage for PT calibration will no longer be necessary. So, the essential units for reporting PT are PTs and INR.

Bibliography

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