Rapid exclusion or confirmation of heparin-induced thrombocytopenia: a single-center experience with 1,291 patients

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Online Supplementary Appendix

Brief tutorial on ROC analysis and clinical application of Bayes' theorem

A Receiver Operating Characteristic (ROC) curve is obtained by calculating the sensitivity and specificity of every observed test value and plotting sensitivity (true positive results; ordinate) against 1–specificity (false positive results; abscissa). A test that perfectly discriminates between two groups would yield a curve coinciding with the left and top sides of the plot and having an area under the ROC curve (AUROC) of 1.0. A test that is completely useless would give a straight line from the bottom left corner to the top right corner and have an AUROC of 0.5.[1] In addition, ROC analysis calculates sensitivity, specificity, likelihood ratios, and positive and negative predictive values for all possible threshold values of a given assay, and identifies the cut-off point with the best compromise between sensitivity and specificity.[2] This is the cut off which creates the smallest total number of false positive plus false negative results.[3]

The positive likelihood ratio (LR +) of a test result is defined as "the probability of an individual *with* disease having a positive test" (true positive) divided by "the probability of an individual *without* disease having a positive test" (false positive) and is calculated as follows: sensitivity / (1–specificity). The negative likelihood ratio (LR –) is defined as "the probability of an individual *with* disease having a negative test" (false negative) divided by "the probability of an individual *without* the disease having a negative test" (true negative), and is calculated as follows: (1 – sensitivity) / specificity.[2] The greater a LR + is, the more useful is the given test result to detect patients with the target disease. On the other hand, the smaller the LR – is, the more useful is the given test result to exclude the disease. By convention, LR + above 10 and LR – below 0.1 are taken as strong evidence to consider or rule out diagnosis in most circumstances.[4]

Applying Bayes' theorem, likelihood ratios can be used to calculate the probability of disease for individual patients.[4,5] This is accomplished by combining the pre-test probability of disease with the likelihood ratio of the test result, either by direct mathematical calculation or by using Fagan's nomogram.[5,6] The mathematical calculation makes use of the odds rather than probability according to the equation: "pre-test odds x likelihood ratio = post-test odds". The pre-test probability p1 can be converted to the pre-test odds with the formula: "p_1 / (1 - p_1) = pre-test odds". After calculation, the post-test odds o_2 can be converted back to a post-test probability with the equation: "o_2 / (1 + o_2) = post-test probability".[4,5]

References

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