COLLEGE of AMERICAN PATHOLOGISTS

INR Discussion

It is well recognized that the various prothrombin time (PT) reagents yield widely differing PT results in patients receiving oral anticoagulation. The primary purpose of the INR system is to minimize this variation, thereby improving the quality of laboratory monitoring and enhancing patient safety.

The sensitivity of PT reagents to coagulation factor levels varies, resulting in different prothrombin times for the same sample, depending on the sensitivity of the reagent used for the assay. The INR is intended to normalize differences in the PT results by accounting for different reagent sensitivities using an ISI. “Mean PT” refers to the mean reference range prothrombin time used by the institution to calculate the INR.

The INR is calculated as follows:

$$INR = (\text{patient PT}/\text{geometric mean of the reference range})^{ISI}$$

In an effort to maximize patient safety, the committee offers the following checklist/actions to assist laboratories in evaluating the situation. Because variation in the PT itself appears less problematic, the checklist emphasizes problems in the INR calculation more than QC and reagent/instrument problems.

- Has an appropriate reference range for your current reagent/instrument been identified?
- Is the geometric mean of this reference range being used in the calculation? Some common software packages (such as Excel) have the capability of generating a geometric mean.
- Is the correct ISI being used in the calculation? The ISI varies not only with the lot of reagent but also with the instrument being used. If in doubt, contact the reagent manufacturer.
- When performing the calculation, the values for the patient PT and the PT reference range mean include one decimal place (e.g., 12.0) and ISI should be included using two decimal places (e.g., 1.05) In each case, three significant digits. The INR should be then rounded and reported to one decimal place (e.g., 2.5; two significant digits).
- How is the calculation being performed? Manually? By the instrument? By the LIS? The calculation should only be performed by one (not more than one) of these methods. Having more than one method in place increases the maintenance efforts and increases the risk of a miscalculation.
- If a manual method of calculation is used, how do you minimize errors?
- Is the calculation tested periodically to assure that the correct INR is being produced? In particular, this calculation must be tested immediately after changing any of the components of the formula (ISI or the geometric mean of the reference range). Actual patient reports should be periodically reviewed to assure the appropriately calculated result is being received by patient care personnel.
- Are specimens collected into 3.2% citrate – not 3.8%? Published reports have documented that INR results differ between the two-citrate concentrations. Some laboratories continue to use 3.8% citrate despite international efforts to standardize on 3.2%.

Coagulation Resource Committee