Deacon's Challenge

No 109 - Answer

Fractionated urinary metanephrines are a useful test for diagnosis of phaeochromocytoma. Your assay has a diagnostic sensitivity of 100% and a specificity of 95%. It is known that that prevalence of phaeochromocytoma in patients under investigation for hypertension is 0.8%.

You investigate 1250 patients in a year. Calculate the number of false positive test results you would generate and the probability that a patient with a positive test result really has a phaeochromocytoma.

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To answer this question it is necessary to calculate:

- the number of true positives (TP) i.e. the number of patients **with** phaeochromocytoma yielding a positive metanephrine result
- the number of false positives (FP) i.e. the number of patients **without** phaeochromocytoma also yielding a positive epinephrine result

If the prevalence of phaeochromocytoma in the population tested is 0.8%, then if 1250 patients are tested within a year then the number of patients with phaechromocytoma is

$$1250 \times \frac{0.8}{100} = 10$$

and the remainder tested (1250 - 10 = 1240) do not have phaeochromocytoma.

Since the diagnostic sensitivity is 100% this means that all patients with phaeochromocytoma will give a positive result so that the value for TP is also 10

Specificity is the percentage of negative results obtained in patients who do not have phaeochromocytoma:

$$\text{Specificity (\%)} = \frac{TN \times 100}{(TN + FP)}$$

Substitute: specificity = 95% and (TN + FP) = 1240 (the number of patients who do not have phaeochromocytoma) and solve for TN:

$$95 = \frac{TN \times 100}{1240}$$

$$TN = \frac{95 \times 1240}{100} = 1178$$

The remainder of the patients without phaeochromocytoma must yield positive results (FP), therefore

False positives (FP) = 1240 - 1178 = **62**

The probability that a patient yielding a positive result actually has phaeochromocytoma is the positive predictive value of the test – PV(+):

$$PV(+) = \frac{\text{True positives}}{\text{All positives}} = \frac{TP}{TP + FP} = \frac{10}{10 + 62} = \mathbf{0.14}\ (14\%)$$ to 2 sig figs

Question 110

Your bench method for making up a 0.2 mol/L solution of anion X^- requires you to dissolve 53.65 g of salt A.X heptahydrate in and make the volume up to 1 L with water. You mistakenly use the anhydrous salt instead. What volumes of water and your solution must be mixed together to correct for this error and produce a final solution of volume 1 L.

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