Editorials

Practising by the evidence: the role of pathology

The term "evidence based practice" and its colleague "clinical effectiveness" have taken many column inches in the clinical literature in the recent past. However, their links to the practice of pathology have been few. This editorial aims to generate a discussion on the role of pathology and pathologists in evidence based practice.

Using evidence as the basis for practice is, on the one hand, regarded as something we have always done and, on the other, as a revolutionary concept challenging current practice. Curiously, both may be correct if we view the evolution of the concepts behind evidence based practice as a response to technological advances. These advances include an improved quality and range of databases such as Medline, availability of such data through CD-ROMs, improved search techniques, aids to systematic ways of appraising a wide range of literature, use of Internet services, etc. Technologically, this enables us to use not just the evidence we come across in routine reading, but much more indepth and systematically collected information targeted at a specific, perhaps immediate, need. In this respect, evidence based practice gives a more solid scientific foundation for clinical decision making, whether this be concerning a patient's treatment, developing a clinical guideline, determining the need for and nature of a service development, or agreeing priorities.

Pathologists have an interesting dual role as they provide evidence for clinical decision making and also have a role of advising clinical colleagues on the use of that evidence. In the first role, pathologists use evidence as the basis of their pathological opinion and the range of tests offered for a given clinical context or problem. The opinion of the pathologist is based not just on experience but research evidence, especially in application of criteria for determining the absence or presence of a particular pathological process and its stage of development.

For the clinician, especially if in training or on unfamiliar ground, the provision of information on a pathological process, be it by naming it or providing some figures to indicate its presence, is not sufficient. In the reporting of pathology evidence, the flagging of key aspects of information is used to promote action on critical findings, be this an unexpected haematological test, the presence of an unusual organism or a poor margin of excision. This may be further amplified by suggesting additional tests, an appropriate antibiotic or a further surgical procedure.

Where reporting is of numerical data, it is traditionally accompanied by reference ranges for age and sex to aid interpretation. However, the evidence is that for some analytes clinically significant change may occur within the reference range—for example, serum calcium and serum prostate specific antigen following total prostatectomy, and that values outside the reference range may have very little clinical significance—for example, a slightly raised thyroid stimulating hormone (TSH) concentration. Data taking on board biological and analytical variation have been used to indicate the level of change of a number of analytes for a change to be considered clinically significant. For instance, an increment of 1.6 mmol/l is needed at a level of 5.8 mmol/l of serum cholesterol to be sure that a change in this analyte has actually occurred.[1]

Many tests are introduced on the basis of trials indicating their sensitivity and specificity from which their predictive power may be calculated. Such trials are usually undertaken using distinct groups of controls and well defined clinical cases of the disease in question and hence raise questions concerning applicability to other clinical contexts in which the tests may be used, and their predictive value in routine clinical situations. For instance, a test for Crohn's disease may work well when comparing cases meeting a full range of diagnostic criteria for this disorder with normal subjects but much less well in a clinic concerned with patients with diarrhoea. Hopefully, researchers are starting to take such messages on board—certainly the uptake of the results of the ISIS trials was linked to the fact that the study subjects were patients 'off the street' rather than selected patients, even though a meta-analysis of available data at the time would have shown the benefit of thrombolytic therapy.[2]

Research pathologists need to ensure, as do reviewers of journals, that publications concerning diagnostic tests meet high standards. Similarly, those wishing to use diagnostic tests should apply such criteria. To use data requires an ability to find suitable material via searching of databases, and mechanisms to retrieve papers to give both maximum sensitivity and specificity have been described.[3,4]

The predictive value of an assay of an analyte gives useful information but does not help with the interpretation of a particular result, such as the predictive value of a TSH concentration which is twice or three times the upper limit of normal or at what creatine kinase activity a myocardial infarction may be considered to have occurred. Data on the latter is discussed by Sackett *et al.*[5]

Although the predictive power of laboratory tests remains the gold standard, it does not address the financial and other implications of testing strategies, even when the costs of tests are known. The development of the number needed to diagnose (NND) is helpful. This is calculated from the specificity and sensitivity data by the following formula:

NND = 1/[sensitivity − (1− specificity)]

The use of NNDs[6] may be enhanced by considering pre- and post-test probabilities of the presence of a condition, as shown by the example of dipstick tests for urinary tract infection (table 1). The overall data are as follows: first, for the overall NND and, second, based on prior probabilities.[7] However, it is necessary to make allowances for pre-test probability of infection and to calculate the likelihood ratios of positive and negative tests.[8]

The NND indicates the number of tests which need to be undertaken in order to gain a positive response for the

Table 1 Urine dipstick tests

	Culture		
Dipstick	*Positive*	*Negative*	*Total*
Positive	60	84	144
Negative	12	210	222
Total	72	294	366

Sensitivity = 0.83; specificity = 0.71; NND = 1.9.

Table 2 *Tests for* Helicobacter pylori

Test	*Sensitivity (%)*	*Specificity (%)*	*NND*
Chronic inflamation	100	66.3	1.51
Acute inflamation	86.7	93.7	1.24
Staining *H pylori*	93.1	99.4	1.08
CLO test	89.6	100	1.12
Urea breath test	90.2	95.3	1.16
Serum IgG antibodies	91.3	91.6	1.21
Serum IgA antibodies	71.1	89.8	1.64

presence of disease and gives a ready comparison between tests (table 2).

However, if cost data are available it is possible to ask questions about the value of biopsy and CLO test at, say, £170 versus an antibody test at £7 when the difference in NND is only 0.09. From this it may be calculated each positive diagnosis costs £190.40 with the former test and £8.50 with the latter. Where there are large differences in costs, the option of using the cheaper as a front line test and the more expensive as the back up may be considered. It is also possible to allow for other "quality" factors such as waiting times and patient acceptability,[10] both of which favour the non-invasive test with the only advantage of the invasive route being that Koch's postulates are more closely met and the possibility that "classic" peptic ulcer symptoms might mask an operable malignancy in a younger person.

Concluding comments

The concepts of evidence based practice are a stimulus to pathologists to:

- use criteria based on research evidence in their diagnostic work;
- apply research evidence in interpretation of laboratory data;
- find new ways of presenting findings to assist their fuller interpretation;
- use cost and NND to help develop rational approaches to testing strategies; and
- help clinical colleagues use research evidence with pathology diagnostic findings more effectively.

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Benefits and limitations of computerised laboratory data

Computers have been an integral part of laboratory life for many years. Their value is self evident—without them many laboratory functions could simply not be done.

Computer functions are not always completely understood by those who operate them, and errors may not be evident or easily detectable. In medical laboratory diagnosis this places a burden on those "in charge" that has service, legal, and ethical consequences. Errors may extend from the quality and accuracy of data, through the adequacy of data storage and processing, and the form of their presentation to peripheral users, to ensuring the availability of reports to those who need them,[1] as well as ensuring that they are not available to unauthorised users.

Direct benefits

Direct benefits encompass administrative elements such as accounting and ordering of material and equipment, as well as professional elements such as quality and extent of service. Much depends on the interests and imagination of the users and developers of the system. The integration of information systems at the Hadassah-University Hospitals in Jerusalem is a good example of microbiology, biochemistry, haematology, and pharmacy data being deployed together to provide relevant data for infectious disease consultants reviewing antimicrobial treatment in individual cases and tracking patients' movements between wards. Similar systems have been developed and applied elsewhere.[2–4] Many would agree that selective reporting of antibiotic sensitivity results,[5] easily achieved in a reasonable computerised system, has a contribution to make in promoting good treatment. "Flagging" selected pathogenic or drug resistant organisms[5] allows the timely alert of clinicians and other professionals, such as infection control personnel. Built-in checks for inconsistencies in data can go a long way towards reducing the task of those scrutinising results before their issue. The internet and world wide web are also being explored for their potential in conformity of reporting practices[6] and in developing more comprehensive clinical laboratory information systems.[7]

Indirect benefits

Indirect benefits may be no less important including monitoring trends of clinical or epidemiological problems, or even appropriateness and extent of laboratory use.[8] A good system would expedite notification of communicable diseases to health authorities.[9] Good in-house or commercially available systems will incorporate these capabilities, and more.

Limitations

LIMITATIONS INHERENTLY DETERMINED BY THE TYPE OF LABORATORY

While data captured on-line from automated tests can be stored and entered into patient records without any manual or subjective input from laboratory personnel, the situation in less automated settings, such as pathology or clinical