OVERVIEW OF IN HOUSE HAEMATOLOGY AND BIOCHEMISTRY

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Introduction
There has been in recent times a real push for the establishment or expansion of the capabilities of the in-practice laboratory, and to rely less on commercial laboratories. This may be for a number of reasons:
1. the development of in house blood and biochemistry machines with increasing capabilities
2. the increasing expectations of the veterinary public (immediacy of reports, monitoring of illness and wellness), in concert with
3. the increasing level of post graduate education available to the practitioner, and
4. the aggressive marketing of companies that offer these test modalities.
This is especially so in small animal practice, such that a large percentage of practices may now have in house haematological and biochemical testing capacity in excess of PCV/total protein, as well as some limited ability to examine urine and faeces.

Advantages of in-house machines

a) Timeliness of results - in an after hours/ emergency/ isolated practice situation these machines can offer very useful initial information that will help in directing diagnosis and treatment, or modifying existing treatment
b) May indicate the need for further testing. If the practice understands the limitations of these instruments, this should include "gold standard" confirmatory testing at a referral pathology laboratory.
c) Can allow in house monitoring of a specific condition, or allow "health checks" in healthy clinically normal animals (this relates to clinic philosophy/income generation/client expectations/quality of care).
d) If there is a veterinarian with interest and expertise in clinical pathology, can add real value to the practice in terms of education, client service etc.
e) Can be seen as a way to generate income for the practice (BUT see disadvantages)

Disadvantages of in-house machines

a) The limitations of the instrument MUST be understood (see below). Inaccurate results can be worse than no results, and set back accurate diagnosis
b) Over reliance of the practice veterinarian for selection and interpretation of the results - this is a very important disadvantage. As pathologists we see time and again conditions not diagnosed for prolonged periods of time because it was not tested for, or animals being treated for conditions they do not have because of over- (usually) or under interpretation of analyte values/test results
c) Lack of a Quality Assurance Program (QAP) – there must be both internal and external QAPs in place to be assured that the results you have are precise and accurate.
d) Investment in capital can drive over reliance on these machines to recoup costs. The decision to buy these, from an economic point of view, is complex, and must take into consideration all of the above, plus ongoing cost of reagents/QAP/staff training/staff time/lease versus buy
e) Ease of use, upkeep etc.
f) Ease of repairs/replacement machines/availability of trouble shooting

Quality Assurance

A lot of consideration must be given to ensuring quality results. Precise and accurate results are useful; inaccurate results are not. The most important ingredient in a successful practice laboratory that generates quality results, besides the instruments themselves, is staff. At least one of the veterinarians should oversee the laboratory, and preferably have an interest in diagnostic testing and Quality Assurance (QA). The practice laboratory does not replace the external accredited laboratory. A close relationship between the practice veterinarians and the pathologists at an accredited laboratory is very useful for both advice, and guidance. The actual day-to-day running of the laboratory should be the responsibility of a trained nominated person, usually a veterinary nurse.

Ensuring quality testing should include a reliable QAP for all in-house diagnostic testing and equipment. Some in house instruments come with internal quality controls and some do not, but all will require internal and external monitoring QA Programs. Maintenance of laboratory equipment should at least be in accordance with the manufacturers’ recommendations, if any are provided. Protocols for all laboratory procedures should be documented for reference so that there is a standard operating procedure.
General comments

Some generalisations about the haematology and biochemistry machines follow.

A) Haematology machine

- The machine should be used to give you a total WBC count, which will be accurate with most modern machines that use impedance and/or laser technology.
- There is good evidence in all non-human species, and with all in house machines independently evaluated to date, to indicate that a manual differential is required. Most private laboratories perform manual differentials in all common veterinary species, even though much more expensive haematology machines are used, as they also have their limitations.
- The platelet count should also be done manually, or at least the smear checked to validate the machine count (significant platelet clumps at the end of the smear can invalidate a machine or manual count). This is a form of internal QA. Some machines may calculate the platelet weight (or crit), and some of these may be better estimates of platelets when there is significant clumping (the new IDEXX, and the old QBC machine).
- The actual PCV should be used in place of the calculated PCV (the haematocrit), as it is more accurate and the PCV tube is likely being used anyway to calculate the total protein. This again is a form of internal QA. There may be considerable difference between PCV and haematocrit, especially in normal bovines, sometimes in cats (may be platelet size, but other factors are important), and in some conditions in all animals e.g. agglutination in IMHA.
- The counting of reticulocytes is required to see if the bone marrow is responding in the face of a measured anaemia i.e. regenerative versus non regenerative. Few machines measure these, and those that do are not sufficiently accurate to be relied upon.
- The calculation of a “left shift” in the neutrophils is mandatory to see if there is an inflammatory demand; it is often a pivotal value in assessing a case and directing subsequent investigations and treatments. Even with well trained haematologists there can be some subjectivity here, and we are not convinced that present technologies are as reliable as the human eye (yet), especially when there are complex conditions occurring eg neoplasia, toxic changes etc.
- It is not uncommon to have low numbers of “abnormal” cells within the blood; machines will not reliably detect these, and their detection may have diagnostic utility.
- Other abnormalities that cannot be identified without a blood film review include changes in red cell morphology such as spherocytes, schistocytes, etc. and inclusions such as Heinz bodies or parasites.
- Some indices such as the MCH and MCHC are insensitive and therefore important changes such as hypochromasia in the red blood cells may go undetected.

B) Biochemistry Machine

- Generally the quality instruments on the market are fairly accurate and reliable. Dry chemistry technology is the most popular, with either individual packaging of analyte tests, or cassette-type testing where a “panel” of tests are performed at once.
- A large number of machines are available to the clinician for in-house use. Most have been assessed for small animals and horses, with fewer for bovines. In a recent survey of a large number of in clinic vs commercial laboratory biochemistry machines using standard quality control material, in-clinic machines did not perform as well as the more expensive laboratory machines, especially when measuring creatinine and chloride. Instruments that were not calibrated daily (some older in house instruments) did not perform as well as those calibrated daily (eg, IDEXX Catalyst and Abaxis VetScan). Older papers make reference to the unreliable nature of Ca results from the older VetTest instrument, but this was confirmed in more recent assessments.

Strong recommendations

1. An examination of the blood film is mandatory for quality results: as well as providing an assessment of the accuracy of platelet number and a more accurate WBC differential count. It allows some comment on WBC morphology (e.g. toxic changes/degree of left shift/abnormal cells), and RBC morphology (e.g. shape changes, RBC parasites/inclusions, polychromatophils, agglutination, spherocytes, acanthocytes etc), and the presence of nRBCs, which are not necessarily in the blood as the result of a regenerative response i.e. they may be inappropriate, and suggest important medical conditions. At a minimum, blood films should be reviewed for all sick animals and also for any analyser results that are unexpected/atypical. Additionally it is strongly recommended that abnormal haematology results from sick animals are confirmed by an external laboratory and reviewed by a pathologist to ensure optimal case management and avoid potential
misdiagnosis/inappropriate treatments etc. as stated earlier (see Disadvantages for In-house machines).

2. A manual PCV should be performed - the haematocrit is a calculated value and is not as accurate as the PCV (and sometimes can be significantly different).

3. A dedicated staff member to take ownership of the instrument - routine QA, for both the instrument, and film assessment.

4. An internal and external QA program should be adhered to.

5. A well thought out training program for the clinic wishing to acquire these instruments, as well as addressing instrument use/upkeep/QA should include some basic haematology/microscope training for staff intending to use the machines. It is important to realise that it requires intensive training to become a useful haematologist, and that there are limitations as to what could be expected in practice.

6. Ongoing support of QA Programs and trouble-shooting for both analysers, as well as pathologist interpretation on abnormal results and blood films.

Summary
In an ideal situation, the proper use of in house testing can add real diagnostic and economic value to the clinic, and stimulate a closer relationship with the pathologists and the reference pathology laboratory allowing maintenance of quality results. It requires, however:

1. an upfront acknowledgement of the limitations of these instruments and of the veterinarians using them and interpreting the results
2. the provision of training to try and address some of these issues; and
3. the need for QA.

If the decision to acquire these instruments is based solely on economics it is likely that the level of care given to practice patients will suffer, potentially markedly.

References