INTRODUCTION

There is a great importance placed on the values generated by the clinical laboratory. Lisa Sanders, M.D. of the Yale University School of Medicine, in a recent article in the AARP The Magazine, quipped that, "Doctors see test results as coming straight from god". Although this sounds humorous, it does show the importance placed on laboratory results. Additionally, it emphasizes the significance of the entire process, in obtaining the correct results thus providing for the best possible care for our patient. Unfortunately it does not recognize all the pre-analytical, analytical and post-analytical factors that may cause spurious results, an erroneous diagnoses, inappropriate treatment and possible harm to the patient.¹

Veterinary medicine is a dynamic profession with technology directly and indirectly taking on a greater role. There is a growing number of veterinary and veterinary technician specialists and specialties, and an ever-increasing availability of better-quality bench and patient-side tests, instruments and outsourced laboratory services.

These changes provide the opportunity for better care for the patient, but can open the door to the possibility of a segmented system where the laboratory process and not the patient becomes the important entity. The slippery slope with this issue is: the shorter exposure time we have with and the more distant we are from the patient, the easier it is to lose sight of them – the old proverb "out of sight, out of mind".

In addressing this issue relevant to clinical pathology, as in other areas of practice, we have a variety of individuals and processes to put into perspective: the patient, client, Veterinary Health Care Team (VHCT), sample collection and handling, testing methodologies and facilities, malady, treatment, costs and a vast assortment of influencing factors that lead us to our success or failure with our patient.

One of the keys to keeping the patient in the forefront is excellence in communication among all the members of the VHCT. This includes the client and extends from the time the contact is made by the client and continues until all issues have been addressed and resolved.

THE PATIENT, COMPUTERS AND THE CLINICAL LABORATORY PROCESS:

We must initially recognize who our patient is and their position relative to the human-animal bond and economic aspect of our society. In addition we must see the patient from a physical, physiological, psychological and environmental perspective.

The process starts with a protocol that includes a plan of care for the patient. It defines everyone’s role, the process and the expectations for the clinical laboratory outcomes: as being correct results and excellence in patient care. The plan is a means of communication of who, what, where, when, why, and how everything is accomplished so everyone is on the “same page”.

Computers, other electronic devices and diagnostic instruments can be major assets in developing, implementing and facilitating the total care and specific clinical laboratory plans. When optimally programmed, these devices can be our reminders and assist in performing tests, gathering, manipulating, storing, integrating and communicating information. This comprehensive data is readily available, easy to read, and track for a multiplicity of purposes, including quality assurance. If so programmed, this information can be an advantage in developing a differential diagnosis, especially for patients with rare disorders or a common illness with unusual signs.²,⁴

Computers and diagnostic instruments are only as good as the programmers and engineers who developed the system; the information, samples and reagents they are provided; and the VHCT members who use and maintain them – “garbage in, garbage out”.

Computers cannot dictate a plan or replace intuition, common sense and intelligence. They cannot see, hear, feel the patient nor provide care and advocacy nor be responsible for the patient. Only the members of the VHCT can provide for these aspects of the process.²

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¹ Sanders, L. "Doctors see test results as coming straight from god". AARP The Magazine, November 2005.
³ The slippery slope refers to the tendency of issues to become more complex and out of control as they are neglected.
The pre-analytic phase of the plan is initiated by gaining as much relevant information when the client calls for the appointment.

Client education starts at this point as well, so they can be prepared to supply pertinent information, as well as know what is required of them in caring for the patient prior to and while in transit for the visit to the clinic or before the arrival of the VHCT at the client’s facility. For example, a urine specimen will be limited in volume if the client allows the patient to urinate immediately preceding arrival at the clinic for a urinalysis – if only they had known. Or the dairy farmer reporting a cow that calved four weeks ago, is off feed, losing weight and down in milk production – ketosis comes to the top of list for the veterinarian’s differential diagnosis. This start of the patient’s care plan may also be the time to obtain the history for the known apprehensive and fractious patients or if the primary care provider will not be available for the appointment.

Once the VHCT has contact with the patient and client, a physical, physiologic, psychological and environmental “picture” of the patient is developed from the signalment, history, examination and diagnostic procedures. There is no piece of information that is too trivial. The smallest piece of information may be the biggest clue. Think in and out of the box.

The signalment (species, breed, gender/reproductive status, date-of-birth/age, description [ex. coat/eye color]) will provide not only an identifying “picture of the patient”, but also will help to include or eliminate possible conditions and related tests associated with one or more of the descriptors. A pyometra is not going to be at the top of differential diagnosis in the case of an “ovariohysterectomized” female Toy Poodle presented with polyuria and polydipsia. In this case, due to breed predisposition, hyperadrenocorticism and diabetes mellitus would be considerations high on the veterinarian’s list, as well as those conditions that are not breed related, such as urinary tract infection.

<table>
<thead>
<tr>
<th>History</th>
<th>Preventative care, vaccination history</th>
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<tbody>
<tr>
<td>Diet, feeding and watering regimen, source,</td>
<td>Environment: geographical location(s), movement,</td>
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<tr>
<td>appetite, changes, fasted</td>
<td>travel, weather conditions, air quality; bio-risk management, bio-security,</td>
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<tr>
<td></td>
<td>bio-containment practices</td>
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<tr>
<td>Bowel movements/urination, frequency, volume,</td>
<td>Other animals (domestic/wild), health status, new arrivals</td>
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<tr>
<td>changes, description</td>
<td></td>
</tr>
<tr>
<td>Emesis/drooling/discharges, frequency, amount,</td>
<td>People, association with other animals, travel, similar conditions</td>
</tr>
<tr>
<td>description</td>
<td></td>
</tr>
<tr>
<td>Medication history (Rx, OTC, compounded,</td>
<td>Behavior, typical vs. atypical</td>
</tr>
<tr>
<td>supplements, anthelmintics, etc.), other</td>
<td></td>
</tr>
<tr>
<td>treatments, source, dosage regimen, means of</td>
<td></td>
</tr>
<tr>
<td>administration, responses</td>
<td></td>
</tr>
<tr>
<td>Medical/surgical history</td>
<td>“Lifestyle” /function (pet, production animal, etc.)</td>
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The history provided by the client will help to better describe the patient, expand or narrow the field of possible conditions and choice of diagnostic tests. The greatest challenge is obtaining all the pertinent information without leading the client to a specific answer. There has been more than one time when cattle have gone off feed in the dead of winter due to a frozen water supply, resulting in a lack of water and feed consumption and not a medical condition. The subsequent, unnecessary ambulatory call is averted, in this case, due to a good history. Or the differential diagnosis on our Poodle, from the example above, is narrowed when the client describes the urine as bloody and the urination process of the patient as “appearing to be painful.”
Examination and Observation of the Patient

<table>
<thead>
<tr>
<th>Temperament, relation to other animals in a multiple animal environment</th>
<th>TPR, CRT, mucus membrane color, hydration status</th>
</tr>
</thead>
<tbody>
<tr>
<td>General appearance, weight, condition, BCS</td>
<td>Body systems</td>
</tr>
</tbody>
</table>

The examination in combination with the history and signalment may provide for a definitive diagnosis, or when questions are unanswered, implements the plan for diagnostic testing to further narrow the differential diagnosis. Despite preceding diagnostic testing, not only have these processes helped define further testing, they will assist the veterinarian in interpreting the results. Common influences may be the hydration status of the patient and the relative increase in chemistry and hematological values in the dehydrated patient, or the patient who has recently eaten and the presence of lipemia in the serum sample.

**SPECIMEN COLLECTION AND HANDLING:**

The goal is to obtain a representative sample without harm to the patient, VHCT or adulteration of the sample.

All aspects of specimen (blood, urine, feces, cytology, microbiological, etc.) collection and handling influence the quality of the results. The amount of influence of poor samples on the results is commonly not easily quantifiable. These potentially spurious results may cause: misdiagnosis, improper treatment and harm to the patient. Therefore, only the samples that meet the criteria set by the manufacturer of the collection device, diagnostic test and instrument should be considered acceptable. Off-site laboratories typically have their own sampling criteria. Deviations from these criteria may only be considered when there is evidence of rigorous testing and validation of a change that will generate reproducible and true results.

Clients must be advised of anything they must do for the patient prior to or after collection, so the tests will not be influenced and no harm will come to the patient.

VHCT members must be proficient in low-stress handling of patients and appropriate types and amount of restraint that will be non-injurious to either patient or VHCT nor influence the test results. Specific knowledge of the anatomy, physiology, behavior and “body language” of the species and specifically of the patient, as well as, the use of the collection devices is a necessity in meeting the goal for sample collection.

Patient influences may include species, breed, gender, age, body condition, size of the patient, demeanor, temperament, diet, hydration status, medications; condition, accessibility and preparation of collection site, and necessity for restraint.

The suspected pathological condition will typically determine the type of specimen to be collected, and in addition to the results, may influence the collection and handling process.

The zoonotic potential of infectious agents must be taken into consideration for the protection of the VHCT, client and others who may come in contact with the patient, specimen or animal products.

Supplies and instruments necessary for collection and handling must be appropriate for the patient, sample and test. Additionally, they must be used in a manner that will provide for valid results and not exacerbate the patient’s condition or cause new problems to develop.

Sanitation and asepsis must be a consideration to prevent infection in the patient and VHCT, or contamination of the specimen.

Proper handling and storage of the specimen is essential to prevent deterioration of the sample. Considerations include: type of species, specimen, timing of collection in relation patient’s condition and test, and time from collection to performance of the test. Other influences include: type of container, temperature, light, preservatives, handling and contamination of the sample.

Samples that are visually unacceptable require re-collection.

Proper identification of the sample including date and time of collection, species, type of specimen and unique patient identifiers are essential.
SUMMARY:

There is no detail so small that can be overlooked in the pre-analytical phase of the clinical laboratory process that will not influence the results and possibility of the wellbeing of the patient. When we care about the specimen, we care for the patient.

To minimize the chance of pre-analytical error, develop a protocol for pre-collection patient management criteria; collection methodologies and supplies; sample identification, handling, storage, and transport. The appropriate protocol sets the standard for initial education and ongoing monitoring.³

REFERENCES: