Semen analysis: the test techs love to hate

By Susan A. Rothmann, PhD, HCLD (ABB), and Angela A. Reese, TS

Semen analysis provides a snapshot of a man’s fertility potential and is an important and critical “gateway test” for evaluating fertility. As a non-invasive and relatively inexpensive test, semen analysis often is the first test ordered when a couple presents for a fertility work-up or when a man is interested in permanent contraception. The utility of semen analysis in assessing reproductive toxicant exposure also makes it an important tool for environmental and occupational health testing.

As a major resource for semen analysis, our technical service department often hears from technologists that they hate semen analysis. A major factor is that semen analysis is practically the last routine manual microscopic test in the laboratory. The lack of reliable, affordable, tech-friendly automation certainly does add to the test’s unpopularity. But when we delve a little deeper, we find that technologists often have little confidence in their results and view semen analysis as an unwelcome chore for reasons that can be corrected easily and inexpensively.

Here are a few of the problems that are commonly cited:

- “Long, complex, tedious, outmoded” are the words techs use to describe their procedures. Many use equipment and supplies not designed for semen analysis and spend a great deal of time to get their results. For many labs, the semen-analysis procedure has been passed on through the years without any effort to modernize or validate it.
- “Inadequate training is a huge problem.” Semen analysis is discussed, at most, for a few hours in medical-technology education and often is not included in clinical training. The testing may not be performed daily, so competency and speed are difficult to accumulate. Hardly any one has the funds to obtain post-graduate training or time to create a training program — and few feel qualified to teach others. Many of the reference books and manuals on semen analysis give conflicting or impractical advice for the lab that primarily performs screening semen analysis.
- “We perform semen analysis, but we do not use quality controls (QC). We know we should but we just do not.” Without the benchmark that QC gives, knowing if a test is performed

LEARNING OBJECTIVES

Upon completion of this article, the reader will be able to:
1. Review the purpose of performing a semen analysis.
2. Understand the problems commonly encountered with semen analysis.
3. List and describe the different components of the semen analysis.
4. Learn how to handle semen specimens properly once brought to the lab.
5. Learn which sperm-count and motility-assessment procedures are more reliable and less time consuming.
6. Learn what is the best way to determine the viability of sperm.
7. Learn what is the best way to prepare and stain a semen smear.
8. Become aware of the different sperm morphology classification schemes and which ones are recommended.
9. Learn the difference between a procedure reference and classification reference.
10. List the four benchmarks for semen analysis and discuss their importance in validating the semen analysis.
properly is very difficult. More labs (but not all) participate in the many available proficiency-testing (PT) programs; but, in many labs, routine CLIA-required QC is overlooked and competency is rarely evaluated outside of a PT challenge.

**General principles of semen analysis**

Semen analysis is actually a panel of tests that measure testis and accessory gland function (see Table 1), each requiring different technology and skills. Each section could be the topic of its own article; but in this summary overview, only practices that can make testing easier or faster will be covered. Practical and cost-effective automation is not available for semen analysis in most clinical lab settings. Computer-assisted semen analyzers (CASA) are very expensive and require a large investment of time to learn and operate. Some new optical technology is available, but its validation has not been widely reported by independent sources, and anecdotal reports suggest that it is unreliable in both accuracy and operation. Still, there are simple ways to make semen analysis less of a chore, and more reliable and useful to practicing physicians and their patients.

Semen is the product of fluids and cells from the testis and the male accessory glands and is composed primarily of the following:

- a small amount of acidic secretions from the prostate that contain zinc, citric acid, acid phosphatase, and prostate specific antigen (PSA);
- secretions from the ampulla and vas deferens containing spermatozoa; and
- alkaline secretions from the seminal vesicles that comprise most of the semen volume and contain fructose and seminalogelin.

Semen should be evaluated 60 to 90 minutes after collection. Recording both the time the sample was collected and the time the sample analysis was initiated is essential. In some settings where samples are transported to a central laboratory, the elapsed time can exceed many hours. It is important that this be avoided, but if it cannot, this delay should at least be brought to the physician’s attention on a report. Sperm motility decreases significantly after three hours and continues to decline over the next six to 18 hours. If delays are inevitable, samples should be kept at room temperature, since exposure to refrigerator or body temperatures increases the decline in motility. Because semen-analysis test volume is often small, scheduling the testing during a single shift and on limited days can reduce operational expense and ensure that properly trained technologists are available at a pre-arranged time. *Ad hoc* semen-specimen “drop-off” and subsequent STAT analysis has no place in most hospital and reference settings, and can be very disruptive to normal lab workflow.

First, the semen is assessed macroscopically by evaluating volume, color, consistency (often referred to inappropriately as viscosity), and liquefaction (the change from the coagulated to liquid state). Any obvious unpleasant odor should be noted as it may indicate infection or excessive sample age. Routine measurement of pH is not necessary. In the case of low volume and complete lack of sperm (azoospermia), pH may give some indication whether the problem relates to dysfunction of the accessory glands or specimen loss during collection, but other tests using biochemical markers are more reliable. PSA causes proteolysis of the seminal-vesicle protein semenogelin to cause semen to liquefy, usually within an hour, thus loss or incomplete secretion of the first (prostatic) secretions during collection can cause incomplete liquefaction. Samples that fail to liquefy or have high consistency can be difficult to mix and pipet, and this should be noted to alert the physician that test results may be inaccurate due to unavoidable sample-handling errors.

A number of references recommend weighing the semen sample to get the most accurate volume measurement. This practice seems overly stringent given the variability of ejaculation during semen collection. Clear evidence exists that for many men, the typical practice of collecting a semen sample by masturbation yields less volume than found during coitus. Thus, volume measures, at best, are an estimate of the man’s natural semen output and probably an underestimate. Using a 5-mL serological pipet gives a volume measurement that is probably as reliable as necessary with much less effort.

Mixing a semen sample is critical for accurate sperm counts. The liquefied sample should be pipetted into a conical centrifuge tube and vortexed at a medium speed for two to three seconds twice. During pipetting, consistency can be evaluated. If the sample leaves the pipet in drops, the consistency is normal; if it exits as a long strand or “thread,” the consistency is high or abnormal. At this point, some procedures recommend placing a drop or a 10-µL aliquot of the semen on a glass slide and cover slipping it to make a “wet preparation” that can be examined qualitatively for the presence of bacteria, round cells, agglutination, or aggregation of sperm to other cells or debris. This extra step can be eliminated if a sperm-counting chamber (see Figure 1) is used. (*Note:* In subsequent text, the term “wet prep” refers to the semen sample observed in a sperm-counting chamber).

**Table 1.**

<table>
<thead>
<tr>
<th>What semen analysis measures</th>
<th>semen volume</th>
<th>coagulation</th>
<th>liquefaction</th>
<th>consistency (aka viscosity)</th>
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<tbody>
<tr>
<td>Fluid and protein products</td>
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<tr>
<td>of male accessory glands</td>
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<td>(indirectly)</td>
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<tr>
<td>Spermatogenesis</td>
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<td>concentration</td>
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<td>motility</td>
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<td>sperm maturity</td>
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<tr>
<td>morphology</td>
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<tr>
<td>viability</td>
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<tr>
<td>Inflammation or infection</td>
<td>leukocytes</td>
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**Figure 1.**

- Sperm Counting Chamber
  - 20 µm
- Hemacytometer
  - 100 µm

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Table 2.

<table>
<thead>
<tr>
<th>Comparison of sperm motility methods</th>
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<tr>
<td>Method</td>
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<tr>
<td>Estimate moving sperm</td>
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<tr>
<td>Count moving sperm</td>
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<tr>
<td>Count non-moving and immobilized sperm</td>
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</table>

Sperm counting

The best way to view sperm is with a microscope equipped with a 20x phase contrast objective. Many clinical labs do not use phase contrast and use a 10x objective, making the procedure much more difficult. Adding phase optics to an existing microscope is a relatively inexpensive way to improve semen analysis.

Many labs use a hemacytometer to count sperm. The hemacytometer was not designed, however, for semen or sperm counts — and using one generates a great deal of unnecessary labor and time, not to mention inaccurate results. The semen must be diluted, requiring duplicate testing of the diluted sample in order to detect dilution errors. The chamber depth of approximately 100 µm is completely inappropriate for a mixture of motile and non-moving cells. Figure 1 illustrates the problem. As time elapses, the non-moving cells settle to the bottom of the chamber. The moving cells continue to swim up and down the depth of the chamber, with the result that all of the sperm are never in the same focal plane, making it impossible to get an accurate count of moving cells. A common mistake is 1) to report no moving cells when, in fact, they are just above the plane of view, or 2) to estimate that all are moving when the non-motile cells are lying on the bottom of the chamber below the plane of view.

The hemacytometer chamber and cover slip must be thoroughly cleaned and dried before reusing, leaving no spermicidal residue. Sperm cells have a tendency to adhere to glass and can contaminate future samples if the chamber is not cleaned thoroughly. Repeated cleaning will gradually wear down the surface, increasing the depth of the chamber and, potentially, leading to incorrect sperm count and calculation values. A hemacytometer that is used regularly should be replaced every one to two years, although many labs use the same hemacytometer for over a decade.

The better choice is to use counting chambers designed specifically for sperm counting and to choose one that is disposable. Sperm-counting chambers have two advantages: They do not require dilution, eliminating the need for duplicate counts, and they have a depth appropriate for semen (10 µm to 20 µm), which allows viewing of the motile and immotile sperm in the same focal plane. Using disposable chambers eliminates chamber cleaning, saving labor and inconvenience while, at the same time, providing a volumetric loading, increasing the precision of the test.

Sperm motility

Sperm-motility testing is another area where many mistakes are made. Many procedures are overly complicated and more time-consuming than they need to be. Three methods in common use are shown in Table 2.

The most common method for performing sperm-motility analysis is estimating the percentage of motile sperm in several microscopic fields and computing the average. Since this is almost completely subjective, the accuracy and precision are poor. Another difficult method requires counting both the motile and the non-motile sperm, then calculating the percentage of motile. If the sperm are moving very slowly and the sample has very few sperm, this method can produce reasonably accurate and precise results; but if the sperm are moving normally and quickly, the method is almost impossible to perform. Since sperm swim randomly, it is difficult to tell whether a sperm at a given point in a chamber was counted before and then swam to a new point. Very rapid sperm in a concentrated specimen are virtually impossible to count.

There are many different staining methods used, not all suited to semen, and some technologists even attempt to determine morphology from unstained wet preps — an impossible task.

An easier, more objective and reproducible method can be recommended (see Figure 2). First, a small (~100 µL) aliquot of the well-mixed, liquefied sample is pipetted into a 1-mL snap-top microvial.

Figure 2.

The vial is placed in a 56˚C water bath for about five minutes to immobilize the sperm. While this incubation proceeds, the fresh semen sample is loaded into a counting chamber and only the non-motile sperm are counted. At the completion of the incubation period, the immobilized sample is loaded into a counting chamber and the number of sperm (which is also

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The objective motility method described above, however, also can be used to discern slow and non-progressive from rapidly progressive sperm, based on the idea that slowly moving sperm can be counted more easily and accurately than rapidly moving sperm. Using the method above, for the fresh semen, one button of a two-button tally is used to count non-progressive and slow-swimming sperm (those sperm that do not move more than one square while counting across a row of squares) and the second button is used to count non-motile sperm. The immobilized aliquot is analyzed as usual. The difference between the non-motile, slow, and non-progressive sperm in the fresh samples and the total sperm in the immobilized sample is the number of rapidly progressive sperm.

Other sperm-count and motility-assessment procedures are outdated and use needless time and effort. Many facilities, in trying to keep the semen sample at 37˚C throughout the semen analysis, require a heated microscope stage. Since short-term sperm motility in semen is not noticeably affected by changes of temperature between room air and body temperature, this practice is unnecessary. Labs that measure sperm motility at multiple times after collection engage in a completely useless and time-wasting measure that yields no clinical information. Some technologists use Gram stains to detect bacteria, but they are usually evident during microscopic exam of the fresh semen or in stained smears. There is little clinical association of bacteria with infection, and they are probably a result of contamination during collection. A peroxidase test can be used to detect white blood cells, but a technologist trained in hematology smears probably a result of contamination of the sample with lubricants, most of which are spermicidal.

Sperm morphology

Sperm morphology is probably the most confusing and time-consuming area of semen analysis. There are many different staining methods used, not all suited to semen, and some technologists use a nuclear-exclusion stain to determine whether non-motile sperm are alive and not able to move, or actually dead (necrozoospermia). Viability testing requires a very simple two-step staining procedure, using eosin-Y as the stain and nigrosin as a counterstain. The method is quick and easy to evaluate. Sperm that exclude the stain are alive, and those that take up the eosin are dead. Both can be visualized well against the blue-black nigrosin counterstain (see Figure 3). In a freshly collected sample, the percentage of motile and viable sperm should be similar, making viability a good check of motility. Since dead sperm do not swim, the number of viable sperm should always be higher than or close to the number of motile sperm. Some accrediting organizations require viability testing when sperm motility is low in order to rule out necrozoospermia. In practical use, the threshold should be very low (less than 10% to 30% motile), since necrozoospermia as a clinical condition is rare. Probably the most common cause is contamination of the sample with lubricants, most of which are spermicidal.

Sperm viability

Sperm-viability testing typically uses a nuclear-exclusion stain to determine whether non-motile sperm are alive and not able to move, or actually dead (necrozoospermia). Viability testing requires a very simple two-step staining procedure, using eosin-Y as the stain and nigrosin as a counterstain.
even attempt to determine morphology from unstained wet preps — an impossible task. There are many classification systems in use, each with its own criteria for what constitutes a normal cell. Some systems report the location of the defects, some report the specific types of defects, and some only report that the cell is abnormal with no indication of why. It is no wonder that people are uncertain what classification or stain to use and how to report the results.

The first step in sperm morphology is to make a good, even semen smear — not too thin and not too thick. Too thin and there will not be enough sperm present for a good evaluation. Too thick and the sperm can be layered and difficult to focus on clearly. Roughly made smears can also separate the sperm heads from the tails as an artifact, leading to an incorrectly high percentage of midpiece abnormalities.

To make the smear, a small drop of semen (approximately 10 µL) should be placed near the labeled end of the slide.30 Another glass slide held at 45° angle is then used to make a push smear or pull smear. This angle can be increased or decreased to make the smear slightly thicker or thinner, depending on the concentration of the sample. Ideally, the smear should immediately be fixed using a spray cytol- ogy fixative, dried thoroughly, and then stored in a dry, dark area until stained.

The best stain for semen smears and sperm is a modified Papanicolaou (Pap) stain.44-46 This provides good clarity for viewing and color differentiation between the regions of the cell. Pap stain is also stable over time, allowing smears to be stored for later review. The typical Pap staining method is time-consuming to prepare and perform; but with many of the stains available commercially, the results are worth the effort.49 A three-step quick Pap stain also can be purchased. Because semen analysis often is performed in body fluid sections of hematopathology, stains such Wright-Giemsa are used. Although rapid and available commercially in onestep and three-step kits, these stains do not provide the same clarity and color variation as the Pap stain (the one-step kits should always be avoided). A particular problem is that semen, which is almost unnoticeable in a Pap-stained smear, stains vivid purple with Wright-Giemsa stains, obscuring much of the fine detail of the sperm morphology. A third option for semen smears is to use pre-stained blood film slides, but the visual quality of these for sperm cells is very poor and the stain is not stable, thus the smears cannot be stored for later review.

No matter what stain is used, the smear should be evaluated using a 100x oil objective with a 10x eyepiece. Basically, each sperm is evaluated, looking at the head, midpiece, and tail (see Figure 4). If any of the three major structures is abnormal, the sperm is classified as abnormal.46 A single key tally is used in one hand to keep track of the number of sperm analyzed, while a multikey tally is used with the other hand to tally normal, borderline abnormal, or abnormal.49 Depending on what information the ordering physician wants, some labs will need to provide the location of the abnormality as well (head, midpiece, tail), and some will need to provide more detail of the type of abnormality, such as shape of head, size, and so forth.44,49,50,51 At least 200 cells must be evaluated.

The major difficulty in morphology is identifying normal sperm as determined by which classification system is used. Ideally, a classification scheme provides

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Table 3.

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<thead>
<tr>
<th>Normal Sperm Morphology from Common Sperm Classifications</th>
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<td></td>
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<tr>
<td>Normal Reference Range</td>
</tr>
<tr>
<td>HEAD</td>
</tr>
<tr>
<td>shape</td>
</tr>
<tr>
<td>acrosome</td>
</tr>
<tr>
<td>size</td>
</tr>
<tr>
<td>vacuoles</td>
</tr>
<tr>
<td>MIDPIECE</td>
</tr>
<tr>
<td>shape</td>
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<tr>
<td>size</td>
</tr>
<tr>
<td>cytoplasmic droplet</td>
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<tr>
<td>TAIL</td>
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<td>width</td>
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<td>length</td>
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a standardized system that allows many observers to compare results and should have clinical relevance and relate in a meaningful way to fertility. Over the last 50 years, five major published classification systems have endured in wide clinical practice: MacLeod, WHO Manual 2nd ed., WHO Manual 3rd ed., ASCP, and Strict, described by Menkveld and Kruger, and promoted in the WHO Manual 4th ed. Table 3 summarizes the main components of these five schemes in common use.

Of these, the WHO 3rd and the Strict/WHO 4th are the modern classifications that are most recommended by fertility physicians. Unfortunately, there are so many variations of the two schemes that learning either one or comparing the results is very difficult.6 Judging from their individual atlases, the two main proponents of the Strict classification do not agree about what is a normal sperm.

Examples of basic sperm morphology are shown in Figure 5. Much of the classification difficulty and controversy arises over just how perfect a sperm must be to be considered normal. In actual practice, smearing, fixation, air-drying, and staining can induce artifacts that must be identified and distinguished from the sperm’s natural morphology.

A comprehensive discussion of morphology classification is beyond the scope of this article and can be found elsewhere. To simplify the topic, we make several recommendations that can be implemented by most labs. For the general reference laboratory that performs semen analysis primarily as a screening tool, the WHO 3rd scheme provides an appropriate starting point for fertility evaluations. In specialized fertility testing and treatment settings, the Strict/WHO 4th criteria is generally used. Keeping in mind that neither has a clear reference standard, a way to distinguish these two schemes is based on classification of borderline abnormal forms (see Table 4).

No matter which classification scheme is used, it is vital to make sure the reference materials are correct. A very common error in morphology classification is to confuse the procedure reference for the classification reference. We asked participants in our July 2006 Proficiency Challenge and in a separate morphology class to list both their classification system and the reference atlas they used (see Table 5). We found that one-third of the proficiency challenge participants and one-fifth of the class attendees were using the wrong atlas for their system, leading to incorrect results. For example, if sperm are classified using the WHO Manual 4th ed. as a procedure reference, but cite Atlas of Sperm Morphology written by Adelman and Cahill as the reference atlas, the system actually used is the ASCP scheme. The Sperm Confirm Atlas of Sperm Morphology compares classification schemes and lists appropriate references.

**Benchmarks for semen analysis: training, quality control, proficiency, and competency testing**

Formal semen-analysis training is rare; and without adequate education, it is very difficult to feel confident about clinical test results. Some professional societies and groups offer instruction, but many reference labs do not have budgets for training when travel is involved. Self-paced training courses and video are available, however, for the lab that wants to improve the technical skills of its staff.

Another reason that semen analysis is the test techs love to hate is that QC is often not used routinely. Many techs (or their supervisors and managers) seem to think that semen analysis is excluded from the CLIA regulations. On the contrary, semen analysis is a high-complexity test requiring two levels of quality controls on each day of patient testing. This not only documents the ability of the technologist to perform the test correctly but also gives him confidence in the results of the test. Without a benchmark that QC gives, knowing if a test is performed properly is very difficult.

**Adding phase optics to an existing microscope is a relatively inexpensive way to improve semen analysis.**

A quality control for sperm count is like that for any other test: one that can be analyzed in any counting chamber or semen analyzer, in the same way as a patient sample. In order to truly mimic a clinical test material, the quality control must resemble the sample being analyzed. In the case of semen analysis, no surrogate materials come close to looking as complex as sperm cells in semen (see Figure 6). Sperm cells are oval and have tails that often overlap or coil around the head, changing the appearance and making them harder to differentiate from non-sperm cells. Semen contains debris, immature germ cells, white blood cells, and other non-sperm cells, some of which can be confused with sperm. Although
latex beads are advertised as a control for sperm count, beads are really not a valid control.\textsuperscript{62} Latex beads are spheres, and are easy to count since they all look the same, and there are no other particles present to confuse the technologist. A suspension of human sperm is the only valid quality control for sperm count.

Sperm-motility quality controls are available in two formats: frozen aliquots of a fresh sample to be thawed for analysis, and video recordings on CD-ROM or other format. The frozen aliquots allow the controls to be analyzed in a counting chamber, but due to the variation in sperm cell death during thawing, the motility of frozen-thawed sperm is highly variable. These controls also require specialized liquid-nitrogen storage and a regular supply of liquid nitrogen, which greatly adds to the expense of the product and to the difficulty in safe handling of the ultra-low-temperature materials.

Video recordings, on the other hand, are easy to use and inexpensive. When video of both the fresh and immobilized samples are provided, these quality controls can be used with any method of motility analysis. The only equipment needed is generally a computer and tally counter.

Quality controls for sperm morphology must be assayed for the classification system being used. Most of the morphology quality controls currently available are assayed for \textit{WHO 3rd or for Strict/WHO 4th} classification schemes. QC for the \textit{Strict/WHO 4th} scheme is especially important as viewers tend to get stricter with time until no normal sperm can be identified.\textsuperscript{63} Assayed ranges for the older classification systems, such as ASCP, McLeod, and \textit{WHO 2nd ed.}, are not commonly provided with controls. Facilities that use one of these classification systems must establish control ranges by analyzing the control slides at least 20 times.\textsuperscript{54,65} Switching to a modern system probably makes more sense. Morphology quality-control smears are usually stained. If the manufacturer uses a different stain, unstained smears from an assayed lot can be obtained to stain in-house.

CLIA requires proficiency testing twice a year for semen analysis\textsuperscript{59,60} and a number of providers offer appropriate PT material. Labs that use automated analysis for any part of semen analysis must be able to

\begin{table}[h]
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\begin{tabular}{|c|c|c|}
\hline
 & \textbf{\% using inappropriate atlas} & \textbf{\% listing no reference} \\
\hline
\textbf{PT} & 32\% & 6\% \\
\textbf{Morphology class} & 19\% & 28\% \\
\hline
\end{tabular}
\caption{Classification system and atlas discordance}
\end{table}

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to analyze PT materials. Proficiency testing for semen analysis identifies many of the analytic problems discussed above. For example, morphology proficiency-testing results often show a range of normal from 0% to 100%. Providers that have innovative virtual challenges for morphology can give a great deal of educational information about sperm classification (e.g., American Proficiency Institute, Wisconsin State Laboratory of Hygiene).

Annual competency testing of each technologist is also required by CLIA. Proficiency-testing results can be used as part of competency testing to show how well the technologist performs compared to the peer group. Additional competency testing should include written examination of important aspects of the topic as well as observation of test performance by a supervisor. With so many supervisors feeling uncertain about how semen analysis should be performed, many labs skip over competency training for this area of lab medicine. Online and written products are available for documenting training and competency.

Summary

At the heart of better semen analysis is professionalism. The walls of many labs are covered with slogans like, “at the end of every test is a worried patient who needs an answer.” Semen analysis is no different. At its end is a couple desperate to have a child or start a family. In spite of the importance of semen analysis in fertility diagnosis and treatment, it remains in most clinical laboratories “the neglected laboratory test.”

The tips and recommendations in this article should help any lab improve the quality of semen analysis while reducing the effort required to produce better results. Knowledge and simple, repeatable procedures, combined with QC and competency benchmarks, can put the interest and satisfaction back into a test that is the gateway for fertility treatment. After all, what is not to love about a cell that swims and comes in so many interesting shapes?

Acknowledgement: The authors thank Jeremy Paul for his assistance with the manuscript.

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References
