Semen Assessment

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KEYWORDS

• Semen analysis • Sperm count • Sperm motility • Sperm morphology • Evaluation of male • Andrology

KEY POINTS

- Semen analysis provides important information on fertility potential, specifically testicular function (ie, sperm production), proper functioning of genital tract accessory glands, and ejaculatory capability.
- A physical examination and thorough medical history evaluation, combined with the results of laboratory semen assessment, provide important information for the clinician to formulate a treatment regimen for the infertile man.
- Arguably, all that is required is to establish whether normal motile sperm are present in the ejaculate. It is common practice to use assisted reproduction, specifically intrauterine insemination even with a severely low sperm count.
- There have been no changes in the methodology for traditional semen analysis since the 1950s when andrology was first coined as a term for the study of male fertility.
- Molecular evaluation of the causes of male infertility is likely the most promising advance in assessing male infertility.

INTRODUCTION

Infertility is generally defined as 1 year of unprotected intercourse without a conception, with approximately 15% to 20% of couples presenting to their physician with such a complaint. Of these, 30% to 40% can be attributed to an identifiable male factor, 30% to 40% to female factors, and the remaining 20% to a combination of both male and female factors.[1,2] Although many couples may present with an obvious and identifiable cause for the subfertility, many present with unexplained reasons for the delay in conception. Traditional semen analysis is the first test used to evaluate the male partner. This article discusses the basics of semen analysis, interpretation of the results, and thoughts on future advances in evaluation of male infertility.

INITIAL ASSESSMENT

Evaluation of the man begins with a thorough history and physical examination, and proceeds to laboratory examination.[1,2] It is important to correlate past history with the results of semen analysis because a person's medical history might affect the results of the semen analysis and hence, fertility potential. Important considerations include past exposures to chemicals, heavy metals, pesticides, extreme heat (specifically the workplace environment as well as recreational activities, such as frequency of hot tubs and use of a heated waterbed). Recreational drug use, as well as prescription medications, history of sexually transmitted infections, and other communicable diseases, genital infections, and genital injuries as well as past fertility history must be taken into consideration when evaluating the

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male partner.[1] The quality of the semen specimen, and hence the analysis, depend on controllable conditions, such as the method of semen collection, collection of the complete ejaculate, and abstinence period, as well as conditions that cannot be changed, such as testicular sperm production, accessory gland secretions, and recent febrile illness.[3] A thorough physical examination, particularly a genital examination supplements the past medical and fertility history and allows the physician to proceed with the laboratory examination.[1,2]

LABORATORY EXAMINATION

The male fertility examination involves at least 2 to 3 semen analyses, preferably with an interval of 3 to 4 weeks between each analysis.[4] It is virtually impossible to characterize the quality of a semen specimen based on a single semen analysis.[3] Examination of multiple semen specimens can at least control for the well-known intraindividual variations seen in semen composition.[3] The standard semen analysis cannot predict fertility, but can provide important clinical information on fertility potential, specifically testicular function (ie, sperm production), proper functioning of genital tract accessory glands, and ejaculatory capability.[5,6]

The standard semen analysis assesses qualitative parameters such as semen color and consistency, as well as quantitative parameters including semen volume, sperm count and total concentration, sperm motility and forward progression or quality of progression, and sperm morphology (**Box 1**). The presence of contaminating debris, bacteria, and leukocytes is also evaluated by light microscopic examination.

Box 1
Qualitative semen assessment versus quantitative semen assessment

Qualitative Semen Assessment

1. Semen appearance and color
2. Semen liquefaction
3. Semen viscosity

Quantitative Semen Analysis

1. Semen volume
2. Wet mount slide for assessing sperm motility and quality of progression; estimation of sperm concentration, presence of debris, bacteria, and cell contamination
3. Determination of sperm count (millions/mL)
4. Determination of percentage of motile sperm
5. Preparation of slide for sperm morphology (smear, fix, and stain)

INTERPRETATION OF SEMEN ANALYSIS

Table 1 shows the current reference ranges for semen parameters. These values are taken from the most current issue of the World Health Organization (WHO) manual published in 2010, which uses reference ranges and reference limits. These data[3] were obtained from fertile men whose partners had a time to pregnancy of 12 months or less. Raw data from 400 to 1900 semen samples from 8 countries were used to generate these ranges. Previous versions of the WHO manual listed reference values as normal and abnormal. WHO 2010[3] a range or spectrum of semen parameters rather then absolute normal or abnormal values, and the major semen parameters have a lower threshold for the fertile population than in previous versions.[3] Recently, Murray and colleagues[7] suggested that with this lower threshold value for the fertile population, fewer men may be referred for evaluation and treatment. Based on the results of the semen analysis, a man would be placed into 1 of the WHO sequential centiles (2.5th to 97.5th).[7,8] The clinician, however, must consider the results of the physical examination and medical history assessment when diagnosing and treating the infertile man. The clinical history and infertility timeline remain the most important aspects that define infertility for each individual couple.[7] Niederberger[8] further states that a man cannot be just placed into the context of the WHO reference ranges, and deemed infertile or

Table 1
Reference limits (5th centiles and 95% confidence limits) for semen parameters

Parameter	Reference Limit
Semen volume (mL)	1.5 (1.4–1.7)
Total sperm number (million/ejaculate)	39 (33–46)
Sperm concentration (millions/mL)	15 (12–16)
Total motility (%)	40 (38–42)
Progressive motility (%)	32 (31–34)
Vitality (live spermatozoa; %)	58 (55–63)
Sperm morphology (normal forms; %)	4 (3.0–4.0)

Data from World Health Organization. WHO laboratory manual for the examination of human semen and sperm-cervical mucus interaction. 5th edition. Geneva (Switzerland): World Health Organization; 2010.