A Review on Forensic importance of Semen
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ABSTRACT

Semen stain analysis has been a task of Forensic Biology and Serology. Analysis of seminal fluid or semen can provide crucial information for the crime scene investigations mainly in sexual assault cases. The first step of identifying such a body fluid is very important since the nature of the fluid is itself very informative to the investigations driven by the importance for forensic applications, body fluid identification method have been extensively developed in recent years. Detection of semen stain depends on microscopical identifications of spermatozoa and enzyme activity based upon the antigen antibody reactions.

INTRODUCTION

Semen analysis is the examinations of ejaculated seminal fluid found at crime scene. Seminal fluid is a viscous, turbid fluid produced mainly from secretions of seminal vesicles (45-80% of volume) and prostate gland (15-30% of the volume). About 10% of the total volume is the combined mixture of the epididymis glands and bulbourethral glands. An average male ejaculate measures around 3.5 ml each ejaculation. Each millimeter can contain between 10 – 50 milion of sperm cell. This numbers can vary with the age of the male, and can be negatively impacted by the medical conditions, genetic background, diet, habit of smoking and use of illicit drugs

COMPOSITION OF SEMEN:

Most of the fluid in semen is made up of secretions from male reproductive organs. Semen contains citric acid, free amino acids, fructose, enzymes, phosphorylcholine, prostaglandin, potassium, and zinc. 46 to 80 % of the fluid is produced by the seminal vesicles, 13 to 33 % by the prostate gland, 5 % from the testicles and epididymis, 2-5 % from Bulbourethral and urethral glands. The normal range of sperm in semen samples is 20 million/ml or more and a total count of 40 million or more
MORPHOLOGY OF SPERM

Sperm have a distinctive head, mid-piece, and tail region. The head of the sperm contains the extremely compact haploid nucleus with very little cytoplasm. These qualities contribute to the overall small size of the sperm (the head is only 5 μm long). A structure called the acrosome covers most of the head of the sperm cell as a “cap” that is filled with lysosomal enzymes important for preparing sperm to participate in fertilization. Tightly packed mitochondria fill the mid-piece of the sperm. ATP produced by these mitochondria will power the flagellum, which extends from the neck and the mid-piece through the tail of the sperm, enabling it to move the entire sperm cell. The central strand of the flagellum, the axial filament, is formed from one centriole inside the maturing sperm cell during the final stages of spermatogenesis.

COLLECTION OF SEMINAL FLUID FOR ANALYSIS

While collecting the seminal sample from the crime scene documentation during collection is very important by the help of notes, photography and videography. A clean syringe or disposable pipette is used for collecting the liquid semen sample found to a clean sterile tube. Also the semen sample can be transferred onto a clean cotton cloth by absorption. The cloth is then air dried, packaged, sealed and labeled properly. If the seminal fluid is found or present on panties, bedsheets, pillows and other movable objects then the objects should be collected as it is found at the scene. If the semen is wet then the sample should be dried before packaging and collection. While dealing with the sexual assault victims the sample must be collected in the form the oral, vaginal and anal swabs and these swabs should be air dried before packaging for one hour. These samples should be collected from the victim as soon as possible before the body begin breaking down of the various components of seminal fluid through enzymes activity.

TESTS FOR DETECTION OF SEMEN

Presumptive tests

Semens are detected using an Alternative Light Source such as Ultra-Violet(UV) light. It is routine procedure to search a crime scene for semen and other fluids using this simple and non destructive method. The Wood’s lamp is a specific device that emits wavelength from about 320-400 nm, and it is very simple, safe and easy to use method. Another alternative source that has been used for seminal fluid is light which has a wavelength range of 415-650nm as well as white and ultraviolet light. The colour of the fluorescence will vary from blue to yellow.

The most popular and accepted presumptive test for the presence of semen is the test for semen is Seminal Acid Phosphatase (SAP). The enzymes have a ability to catalyze the hydrolysis of organic phosphatase which forms a product that will react with a diazonium salt chromogen to cause a colour change. One popular substrate /color developer combination is Alpha Napthyl Phosphate and Brentamine fast blue. Acid Phosphatase will produce a dark
purple colour in less than a minute the shade of purple colour will depend on the age of the semen stain and storage conditions. Non semen AP enzyme reactively is markedly slower than when using the above mentioned spot test. AP activity has been detected in dried samples years after the stain is deposited.
CONFIRMATORY TESTS FOR DETECTION

- **Christmas tree test**

  The nuclear material within the cell is stained red by the Nuclear Fast Red stain. Sperm heads are usually well differentiated with the acrosome staining significantly less dense than the distal region of the head. Epithelial membranes and sperm tails are stained green by the Picric Indigo Carmine (PIC) stain; nuclei inside epithelial cells appear purple. Yeast cells also stain red, however the stain is uniform throughout the cell and extends into polyp-like structures that are occasionally seen in yeast. Combination of Nuclear Fast Red and Picric Indigo Carmine is Christmas tree stain.

- **RSID Semen Strip Test**

  The RSID semen test provides sensitivity as well as specificity to human semen. RSID semen test identifies the presence of seminal vesicle specific antigen or the semenogelin.

**FORENSIC SIGNIFICANCE**

It is useful because of the relative quantity of spermatozoa and epithelial cells can be assessed. This determination becomes important during subsequent DNA analysis because spermatozoa contain male DNA while most epithelial cells in a male–female sexual assault will contain female DNA from the complainant. It is also useful because the relative quantity of spermatozoa and epithelial cells can be assessed. Many times in sexual assault cases semen sample contain contamination like epithelial cell and dust. This can be solved by microscopic examination of sample and also gives information on semen maturity.

**Limitation and benefits of the tests for detection of seminal fluid:**

Presumptive test are playing a imported role when attempting to locate an area of interest for further forensic examination and DNA analysis. Reports of their performance and specificity are available. The presumptive and chemical tests are not human specific and in general are applied sequentially when a mixed body fluid may be present or found. Many rely on the properties of enzymes in body fluid and many of reagents are destructive to the samples.

Sometimes the stains on dark background are difficult to locate and have been visualised by using an alternative light source that use autofluorescence shown by some other body fluid. Usefulness of these methods can be affected variations between the body fluids and the different surfaces. Exposures to such type of light source may cause damage to the DNA in stain. In the absence of the microscopic examination of the semen stain or the spermatozoa, semen is identified by the presumptive tests that detects the seminal acid phosphatase, but this is not unique to the seminal fluid. The PSA is also used for the identification of semen common methods include P30 and another (like ABAcard P30 and Biosign PSA test, although false positive reaction to urine, vaginal fluids, breasts milk and semen free rectal postmortem swabs have been observed.
References


