IDENTIFICATION OF SEMEN TRACES IN SEX CRIME CASES AND THEIR IMPORTANCE IN FORENSIC INVESTIGATION IN PANAMA

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ABSTRACT

The main purpose of this investigation was to carry out an assessment of the latest advances in forensic scientific analytical techniques that have been implemented in the Biomolecular Analysis Unit, in cases of Crimes Against Modesty and Sexual Integrity and the importance of immediate action of the Criminalistics and Legal Medicine team for the search and collection of indications and samples of biological fluids, both at the scene of the events and in the victim himself and in this way the expert of the Forensic Laboratory can obtain efficient and effective results in his Forensic scientific expert evidence endorsed by the specialist community and that can serve as probative material that connects the victim with the sexual offender and be an auxiliary entity to the administration of justice and thus to prove the punishable act. A description of current forensic technical-scientific methodologies was made, used for the search and identification of human semen as well as the great importance that these forensic scientific expert opinions have before a Court of Justice

Keywords: Forensic serology, semen, sperm, Sexual Crimes.

INTRODUCTION

In the criminal investigation of sexual crimes, Criminalistics has been one of the disciplines that have stood out in the clarification of this type of cases. Forensic Genetics, as a disciplinary field of Criminalistic Investigation, has experienced in recent years a great technological advance that has been reflected in the criminalistic investigation carried out in Panama, where it is noteworthy that the Biomolecular Analysis Unit of the Institute of Legal Medicine and Forensic Sciences (IMELCF) is accredited based on the ISO/IES 17025:2017 Standards, complying with all the requirements to maintain it.

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The analysis of biological traces of criminal interest, such as, for example, semen stains and the presence of spermatozoa, provides one of the most requested pieces of evidence by the Public Prosecutor's Office Authorities in the investigation of Sexual Crimes cases in our country.

Currently, the analysis of a tiny stain of semen can often provide valuable data on the individuality of that vestige, which allows the identification of a particular alleged aggressor.

The study of semen stains collected at the crime scene or on the victim is of great importance in criminalistics since it can provide accurate and useful evidence in investigating subject to standardized rules and protocols.

The objective of the present investigation was twofold: on the one hand, to develop a better understanding of the importance of the recognition and collection of semen traces at the scene or crime scene, and, on the other hand, to examine the different forensic technical-scientific methodologies used by the expert witnesses during the analysis of human semen and sperm traces performed in the Biomolecular Analysis Laboratory to be presented before a Court of Justice in order to prove the punishable act.

A description and evaluation of the latest advances in forensic scientific analysis techniques used in cases of Crimes Against Modesty and Sexual Integrity was made, as well as highlighting the importance of the immediate action of the Criminalistics and Forensic Medicine teams in the search and collection of evidence and samples of biological fluids. Likewise, it was possible to analyze and evaluate the innovations in the analysis techniques recently introduced in the Forensic Serology laboratory (sample selection) to be used in the processes of identification of semen and spermatozoa from the samples collected.

JUSTIFICATION

Every day we observe the increase in cases of sexual violence in Latin America and Panama. And to this growing observation, an additional concern is added, since we are faced with the problem that sexual aggressors are using various modus operandi to avoid leaving traces of human semen, such as using condoms or spermicides with their victims or not ejaculating inside the victim, all of which is reinforced by the large amount of information that exists both in social networks and in television programs, so that the aggressors have learned to perpetrate their crime without leaving samples of biological fluids either in their victims or at the scene.

Driven by the emergence of new advances and technologies in the field of Forensic Serology and DNA, forensic experts are forced to make an effort to keep up to date with the latest scientific analysis techniques that will allow them to detect and identify perpetrators with confidence from the analysis of minute amounts of biological fluid samples, such as seminal fluid, in sexual assault cases.

As Greenfield and Sloan (2002) have noted, "Sexual assault or abuse crimes involve physical contact between the perpetrator and the victim and, consequently, the transfer of material, whether hairs, fibers, or biological fluids".

Semen is one of the most commonly found biological fluids at the scene or crime scene in cases of Crimes Against Modesty and Sexual Freedom, where it can be found in the form of dried stains on various supports or can also be obtained in swab samples taken from the victim by the medical examiner.

This evidence acquires great importance in the development of forensic investigations based on the immediate action of the criminalistic field experts in the search and collection of biological fluids, as well as the performance of the forensic doctor in the physical examination of the victim. The good collection of this type of samples or indications carried out with the currently existing techniques, facilitates their analysis and processing, being these fundamental to demonstrate in a scientific and accurate way, to whom the sample belongs.

THE STATE OF THE ART

The purpose of the present research work was, on the one hand, to update our knowledge about the importance of the identification and collection of semen traces in the investigation of cases of Crimes against Prudor and Sexual Integrity, and on the other hand, to identify and evaluate the analytical and scientific techniques currently used in the Biomolecular Analysis Unit of the Institute of Legal Medicine of Panama, Laboratory accredited by the ISO/IEC:17025- 2017 Standard granted by the ANAB (accrediting entity).

The research is part of the **Forensic and Criminalistic Sciences** Line of Research, in the **Forensic and Criminalistic Exercise** Area of knowledge and **Analysis and discovery of evidence** in the Thematic axis.

It should be noted that this research is framed in a non-experimental and descriptive design. It is descriptive because it is carried out through the identification and description of the phenomenon under study, and it is a practical problem, which is directly referred to reality (Hernández, 2018).

Background (Investigative, historical and/or legal).

The crime against modesty and sexual integrity typified in this way in our Panamanian political Constitution, is one of the most serious problems of public health, social justice and human, sexual and reproductive rights, in Latin America and Panama does not escape from this reality.

The researcher Quispe M. (2010) defines sexual violence as "the performance of any sexual act without the consent or desire of the victim. It involves the use of force and produces serious physical, psychological and social consequences".

According to authors Sarmiento G., R., and J. Morris Q. (2003), semen identification is of vital importance in the investigation of rape and other crimes involving sexual assault. Sperm fluid can be presented to the investigator in four different forms: as a stain; impregnated in tissue; as a fluid, mixed with other body fluids, such as vaginal discharge; and finally, as semen or sperm fluid.

Other researchers such as Fan GY, Zhao GS, Mo YN. Zhonghua Nan Ke Xue. (2010), agree that the identification of semen stain, one of the most common human stains, can provide crucial information for crime scene reconstruction and forensic investigation.

Legal Background

Through Law 50 of 2006, which reorganizes the Institute of Legal Medicine and Forensic Sciences; and through Law 69 of 2007, the Criminalistic Services of the former Judicial Technical Police are attached to it. Therefore, forensic laboratories are included, such as the Biomolecular Analysis Laboratory, which is in charge of performing serological tests and human genetic profiling in the Republic of Panama.

It is worth mentioning that Law 50 of 2006, in its article 2, numeral 3 and 4, establishes that the function of the Institute of Legal Medicine and Forensic Sciences is to identify persons, things and places through examinations, inspections, plans, photographs and other technical, scientific

and/or medico-legal expertise and to provide services of criminalistics, analytical identification and scientific and medico-legal investigation.

Based on the above, we can say that the only Laboratory that can issue expert reports on serological and DNA analysis is the Biomolecular Analysis Laboratory of the IMELCF of Panama.

MATERIALS AND METHODS

Procedure

The Biomolecular Analysis Laboratory of the Institute of Legal Medicine and Forensic Sciences is in charge of the analysis related to the identification of biological fluids and obtaining the human genetic profile.

The evidence collected with presumed biological fluids arrives to the Biomolecular Analysis Unit Laboratory from different places, they can be sent from the Judicial Morgue, from the clinic area that are collected by the forensic doctor or also the evidence with possible biological fluids can arrive, for example (clothing, sheets, condoms) collected at the scene of the crime, by the field forensic expert with their respective chain of custody and a request for analysis, which in this case would be the search for traces of human semen and sperm in cases of Sexual Crimes.

Next, the corresponding forms are filled out to give an entry code to the evidence or samples and the application of the legal provisions granted by the competent authority, either physically or by platform, is reviewed and must comply with the policies and requirements demanded by the accrediting entity.

Subsequently, the case is assigned to a qualified expert to analyze the evidence.

It begins in the sample selection area to process the samples starting with the orientated techniques and continuing with the confirmatory techniques. These methods of analysis established by the manufacturers are recognized by the international forensic community, where they were validated in the Laboratory to be used, complying with all Quality Standards.

Sample Selection

Positive control samples from the manufacturers of the indicative tests and positive control samples from the manufacturers of the confirmatory tests were used for the search and identification

of seminal fluid.

As a strategy for collecting information, primary sources were used, such as articles from the manufacturers of both indicative and confirmatory tests, protocols for the search, collection and collection of semen samples, monographs, indexed journals, and articles related to the research topic.

IDENTIFICATION OF SEMINAL FLUID (SEMEN) BY DIFFERENT METHODS OF ANALYSIS (INDICATIVE AND CONFIRMATORY)

The search for seminal fluid is performed by detecting the chemical components of semen including the enzyme acid phosphatase.

Acid phosphatase is an enzyme active in the dephosphorylation of orthophosphoric esters. The isoenzyme found in sperm is prostate specific (López M., Urbano A., Cárdenas M., 2012).

The level of acid phosphatase activity is 500 to 1000 times higher in human semen than in other body fluids or secretions. Elevated levels of acid phosphatase activity have been shown to persist in the vaginal tract after sexual assault. The detection of strong acid phosphatase activity is considered a rapid and reliable indicator of the presence of semen (Quispe Mayta, et al., 2010).

GUIDING OR PRESUMPTIVE TECHNIQUES

The guiding or presumptive techniques are very sensitive preliminary analyses, but not specific for a biological fluid where they are used to orient the expert of the Laboratory, of the possible existence of the biological fluid that is being searched either with alternating light sources or chemical tests.

Among the techniques used in the Forensic Serology Laboratory (sample selection) Semen identification can be by means of low energy alternating light sources such as:

- Ultraviolet light for forensic purposes such as mini crime scope.

Image # 1: Mini crime scope light source

- BigBeam UV light lamp.

Image # 2: BigBeam UV light lamp

Alternating light sources are mainly used to highlight spot patterns that are not visible to the naked eye or with a white light source.

The evidence collected either at the scene of the crime by the forensic field expert or the victim's clothing sent by the medical examiner will be placed in a dark room, each piece of evidence identified separately, even if it is from the same case.

In the event that a fluorescent stain is highlighted, the laboratory expert shall identify it by placing a metric witness in the place where the stain is located, its corresponding number or letter

and take demonstrative photographic views, to record the area where the sample of the alleged semen stain was observed and taken in the evidence.

Subsequently, the expert will proceed to lift the stain and it is at this point where the expert evaluates how to do it according to the standard procedure and endorsed by the accrediting body. They can be lifted in the form of a cut out, whether it is fabric or paper.

If it is adhered to another type of support, the expert may lift it with a swab such as a flip-flop.

If no stain pattern is observed with either white light or low-energy alternating light sources, the possibility of finding traces of semen should not be ruled out. For these cases, another presumptive test known as acid phosphatase will be used.

- The acid phosphatase chemical presumptive test is a rapid test that is used for the detection of semen staining. It is a chemical reaction that when placed on the presumptive stain if it changes to a violet color, it is an indication of the presence of acid phosphatase which as mentioned above, is found in large quantities in the prostate.

CONFIRMATORY TECHNIQUES FOR HUMAN SEMEN

Confirmatory techniques are tests that detect and confirm the identity of a specific biological fluid.

In this case we are talking about evidence or samples with presumed traces of semen, which have already undergone the guiding techniques and the laboratory expert must use rapid tests for the confirmation of human semen, which are simple and reliable and are all accepted by the forensic scientific community for the identification of human semen.

As confirmatory techniques for human semen we have:

- The RSID semen test,
- Search for human spermatozoa by microscopy

METHODOLOGY OF CONFIRMATORY TESTS FOR THE SEARCH OF HUMAN SPERMATOZOA

To perform the confirmation of the sample, the Laboratory Expert must evaluate the type of substrate on which the sample is found and perform a cut in case the sample is on a substrate such as cloth, paper or a vaginal swab.

In case it is an object such as a bottle or it is not possible to make a cut due to the type of substrate where the sample is, the expert must lift the sample with a swab and then perform an elution (it is the process of extracting with an appropriate solvent some substance that is impregnated in a substrate).

After performing an elution, the expert must incubate the sample with the appropriate solvent for approximately one hour and then, perform a centrifugation, the solid part that remains at the bottom of the centrifuged tube will be used to search for spermatozoa.

The supernatant will be stored in a properly labeled tube to be used in later analyses to obtain a spermatozoa profile. subsequent analysis to obtain a human genetic profile.

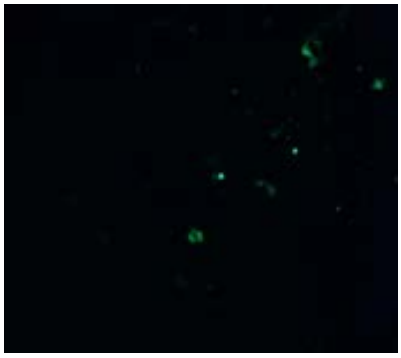

Image # 3: Sperm Hy-Liter test (fluorescent spermatozoa)

CONFIRMATORY TECHNIQUE USING THE RSID SEMEN TEST

After obtaining the supernatant, approximately 20 microliters are taken with 80 microliters of RSID Universal Buffer and mixed with the help of a vortex.

The cassette is labeled and four drops of the supernatant are added. If positive for human semen, the control line and the sample line appear. If it is not human semen, only the control sample line will appear.

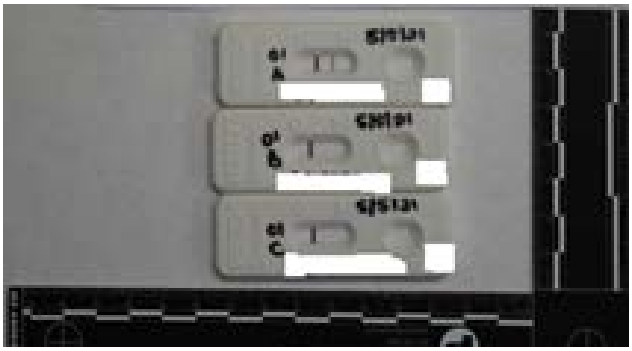

Image # 4: RSID semen testing

RESULTS

The results of this study provide an essential contribution to the understanding of how important it is both when collecting these types of samples and when analyzing with the techniques.

Guideline techniques for semen stains focus on the detection of proteins of specific function.

Recently, more tests have been developed for the search, detection and identification of semen and sperm stains. of human semen and sperm stains have recently been developed.

Although the specificity of such protein markers is relatively high, these methods yield a limited success rate for several factors, including poor stability, low sensitivity of the target protein, and possible subjectivity of the performer (Wen YG, Yu H, Lin JS. 2016).

To overcome these limitations, many researchers have studied and recommended new technologies such as Raman spectroscopy, mass spectrometry for protein markers, sperm-specific aptamers, mRNA, microRNA, and DNA methylation assays.(Wen YG, Yu H, Lin JS. 2016).

These studies indicate that the old techniques for searching for human semen are still useful and many of them are currently used in other Latin American countries. But some of these techniques have their advantages and disadvantages, as explained in the following points:

It was observed that the prostatic acid phosphatase test as an advantage is very sensitive, but it is not very specific since it can give us false positives because it is present in other tissues of various origins.

With respect to the microscopic observation of spermatozoa with Christmas tree staining, which was previously used in the forensic serology laboratory, an advantage of this technique is that it is a confirmatory test for the search of spermatozoa, where the heads are stained red and the flagellum or tail is green, it is a direct observation under the microscope, but among its disadvantages is that it does not allow the detection of spermatozoa in azoopermic (sterile) men.

With the advance of technology, the scientific community also developed new techniques to make them more reliable and specific for this type of biological fluid (semen and human spermatozoa). Therefore, the Serology Laboratory was also able to validate and verify these new techniques to be used more effectively and reliably.

For the search of human spermatozoa, the Sperm Hy- Liter technique is currently used in the Forensic Serology Laboratory in a fluorescence microscope, observing the spermatozoa with fluorescent color. For the search of human semen is currently used the semenolegin test known as (RSDI semen) and as advantages it has no false positives have been described in their studies, but its disadvantage is that it is less sensitive.

Prostate specific antigen tests such as: (seratec PSA semiquant, Hexagon PSA, Rapid signal PSA, ABA card PSA) are also currently used. But its disadvantage is that it can give false positives by presence in sweat and urine of men, elevated in men with prostate cancer, women with Down syndrome or with certain contraceptive treatments.

According to scientific researcher Quispe Mayta S. (2015), “The choice of PSA as a specific marker of semen allows affirming its valuable importance in sexual crimes, likewise several studies have determined that its synthesis and secretion is limited to the prostate

CONCLUSIONS

With this research work we have described how new analytical techniques supported by the scientific community have been implemented and how others have been left behind. Previously, for these cases of Sexual Crimes, a large amount of biological fluid samples (semen) was needed, but with the current techniques only tiny amounts of samples are needed for their detection and accurate identification and thus obtain a positive and reliable result.

In addition, we have been able to observe that, thanks to the training provided and their accreditation to carry out this type of expertise, the suitable forensic experts in the field play an important role in the search, collection and taking of this type of samples.

Finally, although there are new techniques that in many cases are usually expensive, but effective, we cannot completely discard the previous techniques, since in many occasions we will have to resort to them if we do not have the budget to obtain them.

BIBLIOGRAPHIC REFERENCES

- Fan GY, Zhao GS, Mo YN. Advances in identification of semen stains. Zhonghua Nan Ke Xue. 2010 Aug;16(8):735-40. Chinese. PMID: 21090352. Rev.Cs.Farm. y Bioq vol.3 no.1 La Paz jul. 2015.
- Gaceta Oficial, Órgano del Estado, 2006. N° 25692. Reorganiza el Instituto de Medicina Legal y Ciencias Forenses. Pág. # 3.
- Greenfield A.; Sloan M.; 2002. Identificaction of Biological fluids and stains. Forensic Science 1st Edition eBook ISBN9780429257094.
- QUISPE MAYTA, SERGIO E. (2015). Investigación forense del antígeno prostático específico (PSA) en delitos de agresión sexual, en diversos fluidos biológicos humanos de interés forense. Revista CON-CIENCIA, 3 (1), 61-67. Recuperado de http://www.scielo.org.bo/scielo.php?script=sci_arttext&pid=S2310-02652015000100007&lng=es&tlng=es.
- Hernández-Sampieri, R., & Torres, C. P. M. (2018). Metodología de la investigación (Vol. 4, pp. 310-386). México. ed. F DF: McGraw-Hill Interamericana.
- QUISPE MAYTA, Sergio Emilio; TARIFA ESPINOZA, Silvia; SOLIZ PACHECO, Rubén y SIERRA GARECA, Armando. Investigación forense del fluido seminal en víctimas de violencia sexual, por el Laboratorio de Biología Forense. BIOFARBO [online]. 2010,

vol.18, n.2 [citado 2021-12-07], pp. 91-95. Disponible en: <http://www.revistasbolivianas.org.bo/scielo.php?script=sci_arttext&pid=S1813-53632010000200011&lng=es&nrm=iso>. ISSN 1813-5363.

- Sarmiento G., R., and J. Morris Q. "Marcadores para el diagnóstico genérico en la investigación criminalística de semen." Revista Cubana de Química, vol. 15, no. 1, Jan. 2003, pp. 55+. Gale OneFile: Informe Académico, link.gale.com/apps/doc/A146633535/IFME? u=googlescholar&sid=bookmark-IFME&xid=af34ab04. Accessed 7 Dec. 2021.
- Wen YG, Yu H, Lin JS. [Advanced technologies in semen stain identification]. Zhonghua Nan KeXue. 2016 Jun;22(6) 553-558. PMID: 28963848.