



BLOOD IS AN IMPORTANT TOOL FOR CRIME INVESTIGATION

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Introduction

Blood is one of the most important biological traces that are often found on the crime scene. Due to valuable information it contains, it is considered to be a very important forensic tool. Analysis of different aspects of bloodstains can contribute to clarify the circumstances under which some violent crimes have been committed. Such crucial information can point criminal investigation in the right direction and help solve the crime. In some cases it can also help with legal determination of criminal offense which can lead to more accurate and more appropriate punishment for the perpetrator. It is very important to determine the sequence of events during the commitment of a violent crime involving blood.

Evidence is the indispensable part for every crime investigation. Since blood evidence associated with a crime can provide information that may solve the case, it is essential to correctly document, collect, and preserve this type of evidence. Improperly handled blood evidence can weaken or destroy a potential source of facts in a case. Properly collected and preserved blood evidence can establish a strong link between an individual and a criminal act. Blood evidence or the lack of blood evidence can also be used to bolster or contradict a witness statement or any statements that the suspect may make. Blood evidence can also point the investigator in the direction he or she needs to go to solve the case. If blood evidence is documented, collected, and stored suitably, it can be presented to a judge or jury several years from the time of the criminal act. Perhaps the most powerful application of blood evidence is the ability to absolutely eliminate a person as a potential suspect in a crime.

Communication is the key to effectively processing blood evidence. Clear and open communication must exist between a crime scene's first responding officer, the case detective, the crime scene investigator, the forensic scientist analyzing the evidence, and the assistant district attorney handling the case. Of prime importance is the communication between the crime scene investigator and the forensic scientist. A crime scene investigator should know the crime lab's capabilities, the methods of blood collection and preservation preferred by the crime lab, the investigative information relevant to the forensic scientist, and the type of reference samples required by the crime lab. This information may change periodically as technology changes, lab policies change, lab personnel change, or lab administrations change. The preferences of forensic scientists also vary from lab to lab. A good method of blood evidence collection for one forensic scientist may not be a good method for another forensic scientist. The crime scene investigator should meet regularly with his or her crime lab's forensic scientists to determine the most suitable manner for collecting and preserving blood evidence. This ensures that the evidence is collected efficiently and effectively.

The technological state of blood evidence analysis has rapidly advanced in the last 20 years. In the early seventies, most crime labs relied upon the ABO blood grouping system to characterize bloodstains. This meant that the blood could have come from 4 to 49% of the population. In the 1990's, most crime labs are relying on DNA analysis to characterize bloodstains. A blood source can now be statistically narrowed down to one person out of several million or even several billion. (1) A crime scene investigator should know which method or methods of bloodstain analysis are available from his or her crime lab, the FBI lab, and private labs.

Due to the scientific advancement, the detection of the crime, the witness and the offender is easily detected by using of forensic science. In this research, the researcher would like to rectify the admissibility of blood evidence in the court of law. Among the body fluids, which include blood, semen, saliva, urine, nasal secretions, tears, human milk forensically, blood is the most important fluid. It plays an important part in crime detection. It is a mute witness in offence against persons. Now, with the discovery of DNA profiling, which provides a definite identification and linking evidence, it is the most important piece of evidence along with other body fluids to provide proof of the guilt, beyond a reasonable doubt. Remarkable strides in genetics have changed the scenario and the individuality of blood is a reality now. Let us examine the admissibility of blood evidence in the court of law.

Objectivity of Study

The study is conducted keeping in mind the following objectives and purposes:

1. To find out the historical development of blood evidence in court of law,
2. To see the present status of such like tests under Indian Evidence Act.
3. To see the relevancy and admissibility of blood evidence under Indian Criminal Law.
4. To see what tools and techniques to used to detect crime by blood samples.
5. To highlight the case laws relating to admissibility of blood evidence in court of law.
6. To see the disadvantages and consequences in blood sampling.
7. To give an analytical look on the topic of research and prove the hypothesis.

Usefulness of Legal Research

A detailed and in-depth study on the concept of Commission of inquiry and its impact on reports will contribute to the legal field in the following ways:

- This research work will help to ascertain the present legal status of the examination of blood evidence in the court of law.
- This research work is helpful to tools and techniques which are followed to examination of blood evidences.
- This research which is also concentrates the difficulty and drawbacks of the in blood sampling in the court of law.

Research Methodology:

Researcher is of opinion that the books and articles available on the topic of research generally explain the scientific techniques, their procedure, various aspects of law in the light of existing statutes and long established doctrines but somehow there is need to decode the existing statutes broadly to blend new scientific investigation tools and age old laws so as to facilitate the police and other investigating agencies in the administration of justice to detect, reveal and expose high-tech crimes and sophisticated criminals in the present scenario. Analytical method is used to analyse and test the nature of the concept in present scenario with the collection of information through the relevant Commission reports, case laws, legislations, policy documents and judicial decisions of Supreme courts and High courts, articles, newspapers, journals and internet.

Meaning, Definition and Historical preview of the Admissibility of Blood Evidence

Definition of Evidence

The term evidence is defined in Section 3 of the Indian Evidence Act, 1872. In the general sense, the term evidence means facts or observations presented in support of an assertion. In the legal sense, the term evidence can be described as anything admitted by a Court to prove or disprove alleged matters of fact in a trial.

Admissibility

The term “admissibility” means the state or quality of being admissible or permissible. In the legal sense, the term “evidence” means anything admitted by a Court to prove or disprove alleged matters of fact in a trial. Thus, the admissibility of evidence means any document, testimony, or tangible evidence used in a Court of Law. All evidence is not allowed in the Court, only that evidence which is reliable and relevant is admitted in the Court of Law. Evidence is introduced to a judge to prove a point or an important element in a case.

Definition of Admission

The term ‘admission’ is defined in Section 17 of the Indian Evidence Act, 1872. In general sense, the term admission means power or permission to enter, admittance, entrance, access, the power to approach. In the legal sense, acquiescence or concurrence in a statement made by another and distinguishable from a confession in that an admission presupposes prior inquiry by another, but a confession may be made without such inquiry. A fact, point, or statement admitted; as the admission made out of Court are received in evidence.

Principles regarding Admission

As mentioned in *Basant Singh v. Janki Singh*¹, 1966, the principles regarding admission are:

- It states that there remains no difference between the admission of a party in pleading and other admissions thereafter.
- The admission made by a party in a plaint has to be duly signed and verified by that party which could be used as evidence against that party in another suit, but the same could not be termed as conclusive.
- An admission cannot be divided into parts and can only be examined as a whole.
- An admission can only be read in its entire form and no statements can be taken out of the context to form an admission of a certain fact.
- An admission binds the maker to the facts of the case.

¹ 1967 AIR 341, 1967 SCR (1) 1

- An admissibility of a plea of guilt can be determined only if the plea is recorded in the words used by the accused or the person charged with an offence.
- For an admission to have a substantive evidence effect, it should be voluntary in nature. Any admission which is made in ignorance of rights or under restraint in which a person is influenced, whether by lawful or unlawful forceful compulsion of their liberty by implementation of physical enforcement; legally for the incurring of civil liability, of a citizen's arrest, or of subrogation, or illegally for the committing of an offence, of forcing a contract, or of using threats cannot be considered an admission.
- Admissions are limited to being only prima facie proof (not needing further proof unless contrary evidence is shown or produced in the Court of Law) and do not carry a conclusive value.
- Admissions which are clear, in the words of the accused or the person charged with an offence are considered as the best proof of the facts submitted.

Relevance of Admission

The terms 'Relevance' and 'Admissibility' are often considered as synonyms but the legal implication of both the words are very distinct. There's a very prominent phrase to throw light on the difference between the two words. All admissible evidence is relevant but all relevant evidence is not admissible. The word relevance has a broader scope as compared to the word admissibility. Relevance is the genus of which admissibility is the species. These two words can be distinguished from one another in the following manner:

1. Relevancy is when the facts are so related as to render the existence or non-existence of other facts probable according to a common course of events or human conduct, they are called relevant. Whereas, admissibility is when facts have been declared to be legally relevant under the Indian Evidence Act, 1872 they become admissible.
2. Relevancy is founded on logic and human experience. Whereas, admissibility is founded on Law, not on logic.
3. The question regarding relevancy has been enunciated in Section 5 to Section 55 of the Indian Evidence Act, 1872 whereas, the question of admissibility is provided in Section 56 of the Indian Evidence Act, 1872.
4. Relevancy signifies as to what facts are necessary to prove or disprove a fact in issue. Whereas, admissibility is a decisive factor between relevance and proof.
5. Relevancy merely implies the relevant facts. Whereas, admissibility implies what facts are admissible and what is not admissible.
6. Relevancy is the cause. Whereas, admissibility is the effect.
7. In relevancy, the Court may apply its discretion. Whereas, in admissibility, there is no scope for the Court to apply discretion.
8. All admissible facts are relevant. But, all relevant facts are not admissible. Only legally relevant facts are admissible.

Blood Composition

Blood is a complex viscous red fluid with a pH of about 7.4. It is mainly composed of two parts: Cells and plasma. The liquid part is called plasma and the solids are red cells (erythrocytes), white cells (leukocytes) and thrombocytes (platelets). The cells are also known as corpuscles. When the blood flows out of the body a part separates out as blood clots consisting of blood cells, discs and fibrin. Fibrin comes out of plasma and is responsible for clotting of blood. The liquid left is called serum. It is the plasma without fibrinogen which turns into fibrin.

a) Red cells:

There are about five million red cells per micro litre of blood, each about ten micron in diameter. The red cells are continuously being produced and destroyed in the body. The rate of destruction is about ten billion cells per hour in a normal healthy adult.

b) Haemoglobin:

The colouring substance of the red blood cells is haemoglobin. The substance is of great importance to the body functions as it is the carrier of oxygen, injected medicines, salts and food to various body tissues. It is useful in blood examinations.

c) White cells:

The number of white cells is about four to eleven thousand cells per micro litre. They resist the attack of diseases.

d) Platelets:

The number of platelets is about five times that of white cells. They facilitate blood clotting.

e) Serum:

Plasma and serum are complex mixtures of proteins, minerals and organic compounds dissolved in water.

Functions of Blood

The blood performs following functions:

1. It carried oxygen and foo to the body tissues.
2. It helps to eliminate waste products of the body tissues through kidneys and other parts of the body.
3. It regulates the temperature and acidity of the body.
4. It carries administered medicines to the affected parts of the body

Collection and preservation of Blood Evidence

Once the crime scene has been thoroughly documented and the locations of the evidence noted, then the collection process can begin. The collection process will usually start with the most fragile or most easily lost evidence. Special consideration can also be given to any evidence or objects that need to be moved. Collection can then continue along the crime scene trail or in some other logical manner. Photographs should continue to be taken if the investigator is revealing layers of evidence that were not previously documented because they were obscured.

Most items of evidence will be collected in clean, unused paper containers such as packets, envelopes, and bags. Moist or wet biological evidence (blood, body fluids, plants, etc.) from a crime scene can be collected in clean, unused plastic containers at the scene and transported back to an evidence receiving area if the storage time in sealed plastic is less than two hours and this is done to prevent contamination of other evidence. Once in a secure location, wet evidence, whether packaged in plastic or paper, must be removed and allowed to completely air dry. That evidence can then be repackaged in a new, clean, unused, dry paper container. Moisture allows the growth of microorganisms that can destroy or alter evidence.

Any items that may cross contaminate each other must be packaged separately. The containers should be closed and secured to prevent the mixture of evidence during transportation. Each container should have the collecting person's initials; the date and time it was collected; a complete description of the evidence and where it was found; and the investigating agency's name and file number.

Before transporting any items of evidence, the investigator should examine the items to determine if there is any loose trace evidence (hairs, fibers, paint chips, etc.) that may be lost in transportation. If there is, then this loose evidence should be collected in a paper packet and placed in an envelope. The envelope should have the required information giving a description and the source of the trace evidence. The actual item can then be processed and collected.

1. Blood evidence must never be exposed to excessive heat or humidity. If possible, the bloodstained evidence should be refrigerated until it can be transported to the crime lab. The evidence should also be taken to the lab as soon as possible. The following are guidelines, listed in order of the author's preferences, for collecting and preserving blood evidence. Species of origin of fresh bloodstains can be established through microscopic studies and micro measurements sometimes.
2. The part of the body from which the blood has come can be found out from the nature of extraneous matter. Thus, blood from nose, mouth, vagina or anus can be identified.
3. Diseases like leukaemia or syphilis can be detected microscopically.
4. Menstrual blood can be identified.
5. Blood from an infected site can be identified through the presence of puss.

Documentation and Examination of the Crime Scene

An investigator should take a slow and methodical approach to collecting and preserving evidence. The only time that an investigator should make rapid decisions concerning evidence is when the evidence is in danger of being destroyed or compromised. In that case, the evidence should be preserved, or documented and collected as quickly as possible. Before setting foot in the crime scene, the investigator must gather as much information as possible to determine the scope and value of any evidence that may

be present. This information may include witness statements, suspect statements, victim statements, information from the first responding officer, information from the detectives, etc. Information is collected to prevent the destruction of any valuable and/or fragile evidence such as shoeprints, trace evidence, etc. The investigator should then use logic and common sense to search for evidence; however, he or she should also use imagination and avoid becoming narrow-minded. As investigators become more experienced, they know that certain patterns emerge and certain elements are common among similar cases. They also know that they have to keep an open mind when deciding what is evidence and where it will be found. This is due to the unpredictable nature of people and the forces of chaos. Once the investigator has gathered as much information as possible about the case, then he or she should form a mental or written plan to proceed with the documentation, collection, and preservation of the evidence. The investigator should also pass any relevant information to the lab analyst. This will allow the analysis to make decisions concerning the best approach to the analysis and what information can be determined from the evidence.

The investigator should thoroughly document every aspect of the crime scene investigation from the initial walk through to the securing of the collected evidence. Documentation is necessary to record the condition of the crime scene and its related evidence as closely as possible to their original condition at the time of the crime. Of course, there is usually some alteration of the scene that will occur between the time of the crime and the time that the scene is documented. EMS personnel, police officers, and fire fighters may have to alter the original scene in the course of performing life saving measures. Other people entering the scene may also unknowingly or unconsciously alter the scene. In any case, the evidence must be documented in as pristine a condition as circumstances allow. The investigator has a number of tools available for documenting evidence including notes, videotape, photographs, sketches, and chain of custody forms. The investigator may elect to use several or all of these methods of documentation. This documentation will also be used in the future to refresh the investigator's memories of the case.

The first tool for documenting the crime scene investigation is note taking. An investigator should be as thorough as possible when taking notes. All of the pertinent times and actions taken should be recorded, such as who contacted the investigator and when; when did the investigator leave for the crime scene; when did the investigator arrive at the scene; what actions were taken by the investigator and when; when did the investigator leave the scene, etc. Notes should be recorded throughout the entire crime scene investigation.

Examination of the crime scene will usually begin with a walk through of the area along the "trail" of the crime. The trail is that area where all apparent actions associated with the crime took place. This trail is usually marked by the presence of evidence. Point of entry, location of a body, areas where the suspect may have cleaned up, and the point of exit are all included in the trail. The purpose of the

walk through is to note the location of potential evidence and to mentally outline how the scene will be processed. The walk through begins as close to the point of entry as possible. The first place the investigators should examine is the ground on which they are about to tread. If any evidence is found, then a marker should be placed at the location as a warning not to step on the item of interest. When searching for blood evidence, it is important to use a high intensity light. A high intensity light source will aid in the visualization of bloodstains, even stains that have been diluted. The light source can also be used to provide oblique (side) lighting. Oblique lighting is an excellent tool for finding trace evidence and other small items of interest.

As the walk through progresses, the investigators should make sure their hands are occupied by carrying notebooks, flashlights, pens, etc. or by keeping their hands in their pockets. This prevents the investigator from depositing unwanted fingerprints at the crime scene. As a final note on the walk through, the investigators should examine the areas above their heads (ceiling, tree branches, etc.). These areas may yield blood spatters, bullet holes, etc. Once the walk through is completed, the notes must be supplemented with other forms of documentation, such as videotape, photographs, and/or sketches.

Videotape can be an excellent medium for documenting bloodstains at a crime scene. If a video camera is available, it is best used after the initial walk through. This is to record the evidence before any major alterations have occurred at the scene. Videotape provides a perspective on the crime scene layout that cannot be as easily perceived in photographs and sketches. It is a more natural viewing medium to which people can readily relate, especially in demonstrating the structure of the crime scene and how the evidence relates to those structures.

The value of videotaping blood evidence is that the overall relationship of various blood spatters and patterns can be demonstrated. One example of this could be a beating homicide. In this case, videotape can show the overall blood spatter patterns and how these spatters are inter related. The videotape can also show the relationship of the spatters to the various structures at the crime scene. In cases where the suspect may have been injured (such as stabbing homicides), the video camera can be used to document any blood trails that may lead away from the scene. If videotaping indoors, the camera can show how the various areas are laid out in relation to each other and how they can be accessed. This is particularly valuable when recording peripheral bloodstains that may be found in other rooms. The high intensity light source can also be used for illuminating the bloodstains to make them more visible on the videotape.

Whether a video camera is available or not, it is absolutely essential that still photographs are taken to document the crime scene and any associated blood evidence. If a video camera is available, then still photography will be the second step in recording the crime scene. If video is not available, then still photography will be the first step. Photographs can demonstrate the same type of things that the

videotape does, but crime scene photographs can also be used to record close up details, record objects at any scaled size, and record objects at actual size. These measurements and recordings are more difficult to achieve with videotape.

Blood evidence can be photographed using color print film and/or color slide film. Infrared film can also be used for documenting bloodstains on dark surfaces. Overall, medium range, and close up photographs should be taken of pertinent bloodstains. Scaled photographs (photographs with a ruler next to the evidence) must also be taken of items in cases where size relevance is significant or when direct (one-to-one) comparisons will be made, such as with bloody shoeprints, fingerprints, high velocity blood spatter patterns, etc. A good technique for recording a large area of blood spatter on a light colored wall is to measure and record the heights of some of the individual blood spatters. The overall pattern on the wall including a yard stick as a scale is then photographed with slide film. After the slide is developed, it can be projected onto a blank wall or onto the actual wall many years after the original incident. By using a yardstick, the original blood spatters can be viewed at their actual size and placed in their original positions. Measurements and projections can then be made to determine the spatters' points of origin.(10)

Another method of documenting blood evidence is by drawing a sketch of the crime scene. The drawback of photographs is that they are two-dimensional representations of three dimensional objects. As a result, photos can distort the spatial relationships of the photographed objects causing them to appear closer together or farther apart than they actually are. If spatial relationships of the evidence are important or if something needs to have proportional measurements included in it for calculations (such as blood spatter patterns) then a sketch must be made.

Computer programs are available for sketching crime scenes and blood spatters by inputting certain measurements associated with the scene and the individual spatters. This blood spatter program will then calculate and draw the spatters' points of origin. These programs might come in handy where there are many blood spatters and the points of origin need to be determined. For more in depth information on videotaping, photographing, and sketching crime scenes, refer to the recommended reading list.

The final method of evidence documentation is the chain of custody form. The chain of custody form is a written record of all evidence transfers from the crime scene to possession of the court or the clerk of court. Proper chain of custody thoroughly documents the movement of evidence, the security of the evidence, who had possession of the evidence, and when the evidence was in a person's possession? The chain of custody form must accompany the evidence all the way to its final destination. A copy should also be kept in the case folder. The following information must be recorded on the form: A description of the evidence and its container; the specific recovery location of the evidence; case

numbers; the date and time it was collected; who collected it; whether or not the evidence container was sealed upon transfer to another individual; who received the evidence; the dates and times of any evidence transfers; who delivered the evidence; and the final disposition of the evidence. This is necessary to demonstrate that the evidence was not contaminated in a way to alter the information that the evidence originally contained. It also demonstrates that the original evidence was not planted or changed in some way before its presentation in court. After the evidence has been documented using videotape, photographs, sketches, and chain of custody forms, the evidence collection process can begin.

Dried Bloodstains

If the bloodstained item is small and transportable, package it in a paper bag or envelope.

Advantages:

1. Requires a minimal amount of interaction with the bloodstains by the investigator:
2. allows the serologist to make the decisions involved in collecting the samples; dilution and contamination potential minimized by eliminating the use of water as the collection medium.

Disadvantages:

More work for the serologist: bulky items require more storage space.

If the bloodstained item is large or not easily transported, then the following techniques can be used for collecting the bloodstains. If possible, the investigator should also collect samples from unstained areas of the item for negative controls.

1. Cutting out the portion(s) of item with the bloodstain(s). A negative control area should also be cut out if available. Package cuttings in separate paper envelopes.

Advantages: Dilution and contamination potential minimized by eliminating the use of water as the collection medium: requires only a small amount of investigator interaction with the bloodstain: does not usually take up much storage space.

Disadvantages: Investigator must decide which stains and controls to collect: some materials are harder to cut than others.

2. Tape lifting bloodstains - Place fingerprint tape (do not touch sticky surface with bare hands) over bloodstain and surrounding negative control area. Rub non-sticky side of tape with a pencil eraser or other blunt object. This is to insure that good contact is made between the stain and the tape. Lift the bloodstain like a fingerprint and place the tape on a vinyl acetate backing (do not use a paper

backing - paper makes the stain difficult to handle during analysis). The lifting process can be repeated several times on the same stain if necessary. Label the stain(s) and package in a paper envelope.

1. Advantages: Dilution and contamination potential minimized by eliminating the use of water as the collection medium; negative control is readily collected; requires little storage space; fairly easy technique to perform.
2. Disadvantages: Investigator must decide which stains to collect; bloodstains do not lift well on certain surfaces.
3. Scraping bloodstains into a paper packet - Use a clean sharp instrument to scrape the bloodstain into a paper packet. The packet can be labeled and placed in a paper envelope. Do not use a plastic container in place of a paper packet because the static charge from the plastic will cause the blood flakes to disperse and stick to the sides of the container. This technique can be combined with the tape lift method by scraping the stain near the tape's sticky side. The static charge will cause the flakes to stick to the tape. The tape can then be placed on vinyl acetate.

Advantages: Dilution and contamination potential minimized by eliminating the use of water as the collection medium; requires little storage space.

Disadvantages: Investigator must decide which stains to collect; when scraped, bloodstains tend to break into small, very hard to handle flakes; the flakes have a tendency to be easily lost during the scraping process (except when used in combination with the tape lift); some surfaces are not easily scraped.

4. Absorbing stains onto moistened 1/2" long threads - Use only distilled or deionised water to moisten clean, 1/2" long, number 8, white cotton threads. Do not handle the threads with bare hands. Place thread on bloodstain with a pair of clean forceps or a clean cotton swab. Roll the thread on the bloodstain, so the stain is absorbed onto the thread. Repeat until a minimum of four threads are collected. Place the threads (and swabs, if used) in a secure area and allow them to air dry. When air dried, package into a paper packet and place in an envelope. For transportation purposes and to prevent cross contamination, the threads may be placed in a plastic container for no more than two hours. Once in a secure location, the threads must be removed from the plastic and allowed to air dry. They may then be repackaged into a paper packet and placed in an envelope. Threads must also be taken from a negative control area, if available.

Advantages: Stain is concentrated onto a small surface area; requires little storage space.

Disadvantages: Dilution and contamination potential introduced by using water (it may be possible to reduce contamination and dilution effects by using acetone or 70% ethanol to collect bloodstains. At least one study has shown that DNA yield can be increased by using either acetone or 70%

ethanol to collect bloodstains. The 70% ethanol produced a higher DNA yield.(11)); investigator must decide which stains to collect; threads can be difficult to handle.

5. Absorbing stains onto moistened 1/2" X 1/2" cotton squares - The procedure for collection is the same as for threads, except that white, 100% cotton muslin is used instead of threads. The muslin must be boiled in distilled or deionized water and allowed to air dry prior to its use. This removes interfering factors from the muslin. Do not handle the muslin with bare hands.

Advantages: Stain is concentrated onto a relatively small surface area; easier to handle than threads; requires little storage space.

Disadvantages: Same as for threads, except dilution and contamination potential is increased due to using more water.

Wet Bloodstains

1. If the item is small and transportable, then package it in a paper bag (or plastic bag to prevent contamination of other objects). Bring it to a secured location, take it out of the bag and allow the evidence and the bag to thoroughly air dry. Repackage in the original paper bag or, if necessary, a new paper bag. If a new paper bag is used, then the air dried original container should be packaged with the item of evidence.

Advantages: Requires a minimal amount of interaction with the bloodstains by the investigator; allows the serologist to make the decisions involved in collecting the samples.

Disadvantages: More work for the serologist; bulky items use more storage space.

2. If the bloodstained item is large or not easily transported, then absorb the stain onto a 1" X 1" square of the cotton muslin as described in part 2E under dried bloodstains. Package it in paper (or plastic to prevent contamination of other objects). Bring it to a secured location, take it out of the container and allow the cotton square and the container to thoroughly air dry. Repackage in the original paper container or, if necessary, a new paper container. If a new paper container is used, then the air dried original container should be packaged with the cotton square. If possible, the investigator should also collect samples from unstained areas of the item for negative controls.

Advantages: Requires little storage space; fairly easy technique to perform; stain is concentrated onto a relatively small surface area.

Disadvantages: Investigator must decide which stains and controls to collect; investigator must have direct interaction with bloodstain.

Examination of Blood Evidences

The identification and evaluation of blood is based in its composition and behaviour under various conditions.

Cell structure

Since blood is composed of red and white cells, platelets and plasma. The cells have definite shapes and sizes which in different species. For example, human blood cells have characteristic non-nucleated discs with a diameter of about 0.08mm. The identification of cell structure is possible when the blood is fresh and moist usually less than 1 day old. When the blood has dried, it is not always possible to completely regenerate the blood cells. The study of cells is made through microscopy.

Enzymatic activity

Blood contains heme group in haemoglobin. It behaves like peroxidase. It catalyses the liberation of oxygen from oxygen rich compounds like hydrogen peroxide or sodium perborate. The oxygen is used to carry out certain color reactions. The common color reactions for blood detection are benzidine, phenolphthalein, leucomalachite green and luminol reactions.

Other enzymes have been utilized in electrophoretic techniques. When they are subjected to an electric field due to some polarity, they move towards opposite polarity. The rate of movement varies with their structure, weight and electric charge. The pattern of separation is characteristic of blood.

Spectrophotometry

Haemoglobin on treatment with acids, alkalis, reducing agents or oxidizing agents gives a variety of products which have characteristics absorption spectra. They help to identify the blood. The absorption bands are seen in length which is characteristic of blood. **Visual examination**

It is useful to determine whether the given stain is of blood or not. Ordinarily, there is no difficulty in fresh but old stains may not be identifiable. The examination permits:

1. Determination of number and size of stains.
2. Rough estimate of amount of bloodshed.
3. The direction from which the blood has fallen is found from the tip of the elongated stain. The tip of the elongated points out the direction. The shape of the stain indicates the height from which the blood has fallen.
4. Bloodstains from the height of upto 50 centimetres are round sharp edges.
5. Bloodstains from a height of 50 to 150 centimetres have small spike like projections along the edges.
6. Bloodstains fallen from a height over 150 centimetres have corrugated edges.
7. From the positions of the stains, the movement of the victim and the culprit can be determined. If the culprit ran away bleeding, he can be tracked through blood stains.
8. The degree of fluidity, dryness and changes in color permits rough estimation of age of the stains.
9. Gross foreign matter like hair, flesh, bones in the blood may identify the site of injury.

UV and IR Examination

Ultraviolet or infrared rays reveal washed or invisible bloodstains from clothes, furniture, earth, doors etc. They also reveal stains on coloured garments or on painted surfaces. They help to reveal minute blood traces.

Microscopy

Microscopic examination of bloodstains is important in many situations:

1. Species of origin of fresh bloodstains can be established through microscopic studies and micro measurements sometimes.
2. The part of the body from which the blood has come can found out from the nature of extraneous matter. Thus, blood from nose, mouth, vagina or anus can be identified.
3. Diseases like leukaemia or syphilis can be detected microscopically.
4. Menstrual blood can be identified.
5. Blood from an infected site can be identified through the presence of puss.

Spectroscopy

Spectroscopic examination of blood is very useful as well as convenient. The test is usually carried out microscopically. The blood haemoglobin is changed in two or three forms on the slide itself and characteristic absorption are observed. Usually alkali hematin and cyanhaemochromogen are studied for their characteristic spectra.

Chromatography

Ascending paper chromatography using acetic acid, methanol and water solvent system has been employed to study the Rf values.

Electrophoresis

It is used for separation of various enzyme systems. It is being adopted to study the body proteins. This technique is becoming important to distinguish between blood samples.

Colour tests

These tests are the first series of tests employed after visual study of stains. If a stain gives positive color reactions in any of the two color tests, the stain is possibly a bloodstain. If it fails to give color reactions in all probability it is not a bloodstain or the same cannot be established.

1. Benzidine reaction:

Benzidine (0.1g) and dry sodium perborate (0.1g) are dissolved in glacial acetic acid (10ml) and sprayed over the stain. A strong blue color indicates blood.

2. Leucomalachite Green reaction:

The reagent is prepared by dissolving leucomalachite green (0.1g), sodium perborate (0.3g) in 65% glacial acetic acid. The reagent is applied to the stain. Intense green color indicates blood.

3. Phenolphthalein reaction:

Phenolphthalein (1g) is reduced and dissolved in acetic acid (100ml). Sodium perborate (1.4g) is dissolved in the solution and applied to the blood stain. Pink coloration indicates blood.

4. Luminol test:

Luminol is a chemical which has been used to locate the bloodstains. The articles suspected to bear stains is sprayed with luminol. It reacts with blood to give fluorescence. The bloodstains are thus made visible. Even decomposed blood reacts with the reagent. The reagent does not interfere with subsequent blood tests. It is prepared by dissolving sodium perborate (0.7g) in water (100ml) and adding 3-aminophthalhydrazide (0.1g) and sodium carbonate (5.0g) to the solution. The solution is sprayed upon the article with glass sprayers in a dark room. Blood gives strong luminescence.

5. Crystal test:

Two crystal tests are commonly employed. They are specific for blood but they are not sensitive. They often fail if the conditions are not rigidly controlled or if the blood is disintegrated or contaminated.

i. Teichmann Test-

Take a dry crust or smear of blood on a slide. Put a drop of potassium iodide, bromide or chloride (0.1gm) solution in 100ml glacial acetic acid over the blood and cover it with a cover slip. Warm the slide gently till it gives out bubbles. Typically haemin crystals are observed under microscope. Heating may have to be repeated a number of times.

ii. Takayama Test-

It is also performed similarly. The reagent is prepared from one volume of glucose solution (10%), one volume of potassium hydroxide solution (10%) and two volumes of pyridine which are dissolved in six volumes of water.

Precipitin reaction

The reaction is performed to identify the species of the origin of the bloodstains. It is very delicate test and requires only small amounts of blood. A dilute blood solution is used for precipitin reaction. The antisera are not diluted. The blood solution and antisera should be free from turbidity and contamination. Ultraviolet or infrared rays reveal washed or invisible bloodstains from clothes, furniture, earth, doors etc. They also reveal stains on coloured garments or on painted surfaces. They help to reveal minute blood traces.

Conventional Serological Analysis

Analysis of the proteins, enzymes, and antigens present in the blood. These substances are more susceptible to degradation than DNA and this type of testing usually requires a "large" sample (quarter size) in good condition for optimal results. This type of testing is rarely statistically individualizing.

Restriction Fragment Length Polymorphism (RFLP) DNA analysis

Direct analysis of certain DNA sequences present in the white blood cells. DNA is much less susceptible to degradation than proteins, enzymes, and antigens. RFLP DNA testing is commonly statistically individualizing (one out of several million or several billion) and it has withstood rigorous court challenges on its validity. This method also usually requires a "large" sample size to obtain significant results.

Polymerase Chain Reaction (PCR) DNA analysis

Analysis of certain DNA sequences that have been copied multiple times to a detectable level. PCR based testing works well on degraded samples and "small" samples (pinhead size). Currently, it is not as statistically individualizing as RFLP analysis; however, more DNA sequences for PCR analysis are being discovered and in the near future it will be as statistically individualizing as RFLP. PCR based technologies have also withstood rigorous court challenges on its validity. Recently, there has been some concern over the possibility of incidental contamination giving false results in PCR tests. At least one study has shown that if PCR protocols are followed, it is not likely that incidental contamination will give false results. The only way that false results were induced was by direct cross contamination of wet samples. (2)

Presently, the courts do not recognize blood evidence as evidence that can be absolutely linked to an individual, such as fingerprints, bitemarks, broken fingernails, and handwriting. If DNA analysis is utilized, then blood evidence falls into the category of evidence that can be linked to an individual with a high degree of probability. Originally, RFLP DNA analysis was given the misnomer "DNA fingerprinting." The courts have since ruled that a DNA result can only be given in statistical terms. A forensic scientist cannot testify that a bloodstain came from a specific individual. He or she can testify that based on population studies, only one person in several million or billion has a particular DNA profile. He or she can then testify if the suspect or a victim has that DNA profile.

Before a crime scene investigator begins documenting and collecting blood evidence, he or she must recognize the value of this evidence and how it fits in the overall events associated with the crime. The most common applications of blood evidence are:

1. Finding blood with the victim's genetic markers (ABO blood type, DNA profile, etc.) on the suspect, on something in the suspect's possession, or something associated with the suspect.
2. Finding blood with the suspect's genetic markers on the victim, on something in the victim's possession, or something associated with the victim.

3. Investigative information determined from blood spatter and/or blood location.

Generally, blood evidence is usually more informative in cases where a suspect and victim are in contact or close proximity. For example, if a suspect stabs or beats a victim, there could be an exchange of blood between the victim and the suspect. If a suspect shoots a victim from across a room. It is less likely that an exchange of blood will occur.

Occasionally, investigators blindly collect blood samples from a scene without any thought about the facts they are trying to establish. An example is a crime scene consisting of the body of a shooting victim found alone in his residence. Some investigators will collect several blood samples from around the body. This is unnecessary since it will only establish that the victim bled at the scene of the crime. This fact is already proven by the presence of the body; however, one sample of pooled blood next to the body can be collected to confirm the results obtained from the victim's reference blood sample.

The crime scene investigator must make an effort to collect the evidence that is going to provide the most useful information in establishing the facts about a crime scene. The investigator must balance this with the philosophy of too much evidence collected is better than not enough evidence collected. The investigator should concentrate on collecting representative samples of the "peripheral" bloodstains, such as the bloodstains that are away from the body and the main area of action, or blood spatter patterns that differ from the majority of the blood spatter patterns. These bloodstains may provide useful investigative information. The investigator should also search for blood trails leading away from the scene. These trails could have originated from a wounded suspect. If a suspect is established in a case, then he or she should be examined for wounds. The suspect's wounds should be documented and photographed. This is additional useful evidence if blood with the suspect's genetic markers is found in an incriminating location.

Because blood analysis is a comparison analysis (comparison of the victim's blood and the suspect's blood to blood found at the crime scene), reference blood samples are needed from the victim and suspect. A comparison must be made between the genetic markers in the victim's blood and the suspect's blood. The blood samples from the crime scene can then be analyzed for those genetic markers that are different in the suspect and victim. This is especially true in conventional serology analysis. Requests are made occasionally to do an ABO blood type determination of blood on a suspect's clothes to a known blood sample from a victim. This type of analysis is useless without a known blood sample from the suspect. If both parties have the same ABO blood type, then part of the sample has been wasted and no real information of value is produced. If reference samples of blood from both parties are provided, then it can be determined if they have the same ABO blood type. If they do, then further analysis of the reference blood samples may show that the two parties have different PGM types. The unknown stain

could then be analyzed for the genetic marker PGM. This analysis may then show the possible origin of the stain.

Suitable reference samples (a suitable reference sample is collected directly from a person into a tube or "Vacutainer") from all of the involved subjects must be sent to the crime lab. An unsuitable reference sample is bloody clothing or some other bloody item. These are unsuitable because the histories of these bloodstained items are usually questionable and there may be factors present on the items that will give misleading results. The sample must be collected in the proper "Vacutainer." The investigator should check with the lab he or she is using to determine the analysts' preferences on reference sample collection tubes. This is a summary of the forensic uses of "Vacutainers":

If the investigator is collecting blood from an autopsy, then one of each type of Vacutainer should be collected from the victim. This will insure that any necessary forensic testing can be performed. These Vacutainers should be stored in a refrigerator (not frozen) at about four degrees Centigrade until they are transported to the crime lab.

In recent years, blood visualization enhancing chemicals have regained popularity with crime scene investigators. The chemical of choice is usually luminol. Luminol is a chemical that when applied to bloodstains, even very dilute bloodstains, will cause the bloodstains to glow in the dark. Because it has several drawbacks as a presumptive test for blood, spraying luminol at a crime scene should be an investigator's last resort for detecting blood. The problems with luminol include:

1. One of the empirical tests for determining if a stain is blood is its appearance. If it is a bloodstain, then it should look like blood. A bloodstain also has to be present in sufficient quantity to perform confirmatory testing and testing for genetic markers. This requires that the bloodstain is visible to the naked eye. The luminol reaction is at best a presumptive test for blood. If the stain is so dilute that it can only be visualized with luminol, then no further analysis can be performed to confirm the presence of blood.
2. Luminol will give false reactions. Luminol will react with copper ions, copper compounds, iron compounds, and cobalt ions. It will also react with potassium permanganate (found in some dyes) and hydrated sodium hypochlorite (bleach).(6) Ferricyanide and plant peroxidases could also give false reactions.(7)
3. Studies have shown that luminol will cause the loss of several genetic markers.(8,9)

4. Because luminol is water based, it could cause, latent, possibly bloody impressions to smear. Luminol could also further dilute an already diluted stain. This may push the stain beyond the genetic marker analysis detection limits.

Unfortunately, some crime scene investigators use luminol as their first choice for detecting blood. By using luminol in such a reckless manner, it is possible to lose valuable information from a bloodstain. When searching for blood at a crime scene, especially blood that may have been cleaned up, the investigator should first use a high intensity light to search for any traces of blood. Bloodstains are not easy to eradicate. Diluted blood will often leave a brownish stain where a person has tried to clean it. Blood also has a tendency to flow into floorboard cracks, into carpet padding, behind baseboards, etc. By conducting a thorough examination with a high intensity light source, the investigator can usually find these areas. These items can then be removed or collected and submitted to the crime lab for confirmatory testing.

Because luminol is so sensitive to dilute bloodstains, it is occasionally used to enhance bloody impressions (shoeprints, fingerprints, etc.). Luminol is not the best reagent for enhancing these impressions because of its water base. Better methods for enhancing bloody impressions use either rapidly evaporating organic solvents (such as merbromin and ortho-tolidine) or they use a water based chemical after treating the impression with a fixative (such as the amido black staining technique).

Once the investigator realizes the potential of blood evidence as well as problem areas in documenting, collecting, and preserving this type of evidence, he or she will be more effective in finding the best bloodstains. Some commonly encountered problems are lack of communication (especially between the investigators and the forensic scientists), unfamiliarity with the types of bloodstain analysis, lack of knowledge about which stains will yield the most useful information, poor reference samples, and indiscriminately using luminol at crime scenes. If these problems are solved, then the blood collection and analysis should progress without any major problems.

Admissibility of Blood Evidence in the Court of law

Blood Trail

It was argued with great vehemence in the High Court as well as in the court sessions that there was a trail of blood from the front door of the house of the vakil into the rooms marked H in the plan and that supported the defence theory that the deceased Kannan received the stab injuries not in or near the house in question but somewhere far away near the railway station. The High Court took the view that if kannan had received the injuries somewhere outside the house it is impossible for him to have come into the room in view of the doctor's evidence.

It was concluded on the material placed on the record that there could be no room for doubt that Kannan received in the itself and not outside, and that he was carried out of the room while life was still lingering and therefore there would be dripping of the blood from the room while life was still lingering and therefore there would be dripping of the blood from the body during the course of transit as the injuries were very serious and vital arteries had been cut.

The defence version that the victim was injured somewhere far away from the house where blood trail was found. The findings of the doctor that the victim could not walk to reach the house negated the version. He carried to the place while still alive dripping blood created the trail.

Blood Pool

In the case of *State of Punjab v. Behari Lal Padu Lal*², the evidence shows that although two injuries were caused and one of the questions which had been raised by the defence was that there was no blood at the spot, no attempt was made by the prosecution to show the reason why there was no blood on the cot on which the dead body of Chaggar Singh was carried, nor was there blood in the compound where the dead body was lying nor a trail of blood to the house.

Blood Group Establishes Incident at the spot

In the case of *Anil Kumar V. State*³, the presence of the blood groups belonging to the injured and the deceased on the various exhibits lifted from the spot conclusively establishes that the incident had taken place at the spot from where the exhibits were lifted. **Relevancy of the Blood Evidence**

In the case of *Tulsiram Karu v. State*⁴, the chemical examine, in a **murder** case, found **bloodstains** on the clothes recovered from the house of the suspect. However, the serologist failed to identify the stain as human **bloodstains**. The discovery of a blood **stained** piece of cloth from the house of the appellant leads to no conclusion.

Relevant Extracts

In a case of *Abdul Salam v. State*⁵, in a case like this what happens generally is that the police immediately in the presence of witnesses takes possession of the articles containing bloodstains and at once seals them so that it is not open to the accused to come out with the defence that these **bloodstains** might have been placed by the police. In the **present** case the door leaves were for several days in the custody of the police and it is possible that somebody connected with the prosecution might have placed these stains on them.

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As regards the recovery of a shirt or a dhoti with blood stains which according to the serologist report were stained with human blood but there is no evidence in the report of the serologist about the group of the blood and therefore it could not positively be connected with the deceased. In the evidence of the Investigating Officer or in the report, it is not clearly mentioned as to what were the

² AIR 1953 P&H 218

³ 2018 ADR 168.

⁴ AIR 1954SC 1.

⁵ 1953Cr LJ 1865.

dimensions of the stains of blood. Few small blood stains on the cloths of a person may even be of his own blood especially if it is a villager putting on these clothes and living in villages. The evidence about the blood group is only conclusive to connect the blood stains with the deceased. That evidence is absent and in this view of the matter, in our opinion, even this is not a circumstance on the basis of which any inference could be drawn.

Conclusion

Hence, evidence is admissible in Court proceedings only if it is relevant to the facts or issues or matters in dispute. If evidence is admissible but irrelevant to the case then it is only a waste of time for the Court. Thus, evidence shall be relevant and shall also satisfy all the specified provisions of admissibility then only it can be admissible in the Court of Law. As of the present situation, even the electronic or digital records are admissible as evidence as they are reliable, relevant and obtained from an authentic source of electronic communication.

Evidence is the most integral and indispensable element of any proceedings either criminal or civil and shall be safeguarded from any kind of manhandling or else it might turn inadmissible in the Court.

