

Forensic science in medicine: What every doctor in SA should know

A brief review and guide for the medical practitioner in identifying, collecting and handling biological and other samples which may be used in legal proceedings

Katrin Müller, MBChB DTG (Pret)

Department of Forensic Medicine, University of Pretoria

Gert Saayman, MBChB MMed(MedForens) (Pret) FCForPath(SA)

Department of Forensic Medicine, University of Pretoria

Introduction

“Wherever he steps, whatever he touches, whatever he leaves, even unconsciously, will serve as a silent witness against him. Not only his fingerprints or his footprints, but his hair, the fibres from his clothes, the glass he breaks, the tool mark he leaves, the paint he scratches, the blood or semen he deposits or collects. All of these and more, bear mute witness against him. This is evidence that does not forget. It is not confused by the excitement of the moment. It is not absent because human witnesses are. It is factual evidence. Physical evidence cannot be wrong, it cannot perjure itself, it cannot be wholly absent. Only its interpretation can err. Only human failure to find it, study and understand it, can diminish its value.”

- Professor Edmond Locard (1877 - 1966)

SA Fam Pract 2003;45(6):41-45

French scientist Edmond Locard, an early pioneer in forensic science, postulated that when two objects came into contact with each other, each of these objects would leave or transfer particles to the other. This became known as “Locard’s Exchange Principle”. Locard was also credited with setting up the world’s first modern crime laboratory in the beginning of the twentieth century.

Until the late 1990s, medical practitioners appointed as district surgeons were primarily responsible for rendering clinical forensic medical and medico-legal investigation of death services in South Africa. In each magisterial district therefore, there were usually one or more medical practitioners who were particularly exposed to medico-legal work and generally had sufficient exposure to this field of medical practice, in order to develop and maintain appropriate expertise. However, clinical forensic medical duties (including the medico-legal examination of victims of interpersonal violence, child abuse, sexual assault as

well as the examination of alleged drunken drivers) were subsequently classified as being services which *all* state-employed doctors at clinics and hospitals should render, and that dedicated medico-legal practitioners would no longer be appointed for this purpose. This has had a number of effects, one being that especially junior and inexperienced colleagues are now routinely called upon to perform these services, compile medico-legal reports and to participate in the subsequent legal proceedings where necessary, as called upon by the prosecuting authorities or defence counsel. In particular, the inexperience (and indeed, often reservations and unwillingness) of clinicians with regard to these duties, has compromised criminal justice proceedings and provided ample opportunity for defence attorneys to inappropriately secure the acquittal of their often guilty clients.

Another outcome has been that victims are now more inclined to present at private medical facilities or practices, rather than at state institutions. It is thus

safe to suggest that substantially more practitioners are now (and will in future be) called upon to render such medico-legal services – whether it is at the request of the SAPS or the patient/victim him or herself.

Not only is it essential that doctors perform meticulous clinical examination in medico-legal cases – the adequate documentation of findings and the appropriate identification, harvesting and handling of other evidence which may derive from the person of the victim *or perpetrator*, is essential for successful criminal justice administration. Doctors should appreciate the need to view the body of the victim (or perpetrator) as a “crime scene” from which abundant and often decisive evidence and/or clues may be derived. Medical practitioners should also understand that it is the intent of defence attorneys to find fault with the method of examination, documentation of findings or conclusions reached as well as the process of procuring, handling or investigating specimens for further scientific analyses.

Mistakes can rarely be corrected at a later stage, and evidence not identified or collected incorrectly may be lost forever. The present rate for obtaining a successful prosecution in sexual assault cases in South Africa is less than 10%, compared to above 80% and even near 100% in some states of the USA. Part of this poor outcome can be ascribed to inexperienced role players in all components of the criminal investigation, including law enforcement officials and medical practitioners who examine victims and alleged assailants.

During a criminal investigation both objective and subjective clues must be discovered. Accurate and objective observations and inferences made from the relevant facts are necessary for confirmation of a crime, identification and apprehension of the offender and eventual administration of justice. Collecting (and recording) evidence or facts is the fundamental character of a criminal investigation. Individualisation refers to the identification or exoneration beyond reasonable doubt of the perpetrator or alleged criminal in the act committed.

During the twentieth century, the application of knowledge of various scientific disciplines to combat crime has developed remarkably. Today, forensic applications in fields ranging from engineering, geology, botany and photography to entomology, pathology and toxicology are common. It is important that South African health professionals be informed of these advances, at least in so far as we may then appropriately use these services or disciplines to facilitate the judicial process.

South Africa has one of the highest rates of interpersonal violence, in all its forms, in the world. For each of the approximately 25 000 murders committed each year in this country, there are many, many more cases of serious injury, child abuse and sexual assault. It can well be said that knowledge and skills in the field of clinical forensic medicine are *core requirements* for the South African doctor.

It is beyond the scope of this article to provide a detailed review of the various scientific disciplines with

forensic applications. Suffice to say that clinicians who may be called upon to perform these services should be aware of the nature and type of services available, how specimens should be procured and handled and, in some instances, be capable of interpreting the findings of special investigations (especially alcohol or drug concentrations). A large spectrum of possible sources and/or types of hard physical evidence can and should form part of the total spectrum of scientific analysis that contribute to crime investigation today and these should be considered, sought and appropriately used by health professionals - in the performance of their forensic medical duties.

The following are mere examples of evidence which may readily be found on the body or clothing of the victim and perpetrator: body fluids and blood; hair; skin residue (under fingernails); clothing/material fibres; finger-, palm- and footprints; glass fragments; hair; oils, grease, cosmetics, paint and paint products; soils, minerals, wood and vegetation residue. Even the traces of saliva left on a cigarette butt at a crime scene, or a few flecks of dandruff, are today sufficient, through polymerase chain reaction (PCR) techniques, to provide sufficient material to perform DNA-fingerprinting for identification purposes.

In addition, health professionals should be aware of some of the adjuncts that professional crime investigators have at their disposal, in order to understand their own role better. These include ballistic studies (firearm and projectile examinations); computer hardware and software analysis; toolmark examination; questioned document analysis; serial number comparisons; applied engineering principles; advanced photographic techniques; laser and varied spectrum light techniques, and many more.

Doctors should be aware of their pivotal role in the criminal investigation and subsequent prosecution in cases of interpersonal violence and sexual assault. We should be knowledgeable of the workings of the criminal justice system and court procedure and etiquette, and sensitive to issues such as burden of proof, preservation of chain

of custody of specimens and other evidentiary items and issues of consent and confidentiality in criminal proceedings.

LEGAL FRAMEWORK

- In *S v R and Others* 2000 (1) SACR 33 (W) it was held that the fundamental test for the admissibility of evidence was its *relevance* and that the evidence must be *obtained constitutionally*. Only a trained official is entitled to gather DNA samples from a crime scene (Smith, SAPS DNA Unit Commander, November: 2001) and only a registered medical practitioner or registered nurse from a person (Section 37 (2) (a) **Criminal Procedure Act 51 of 1977**).
- No specimens may be collected without specific *informed consent* from a patient or a legal instruction from the investigating officer, given by means of *fully completed SAP 308 or SAP 308(a) form*.
- In South Africa the taking of blood samples is statutorily provided for in Section 37 of the **Criminal Procedure Act (Act 51 of 1977)**. Section 37 (selectively quoted here) reads:
 - “1. Any police official may –
 - a. take the fingerprints, palmprints or footprints or may cause any such prints to be taken –
 - i. of any person arrested upon any charge; ...
 - iv. of any person upon whom a summons has been served in respect of any offence referred to in Schedule 1 or any offence with reference to which the suspension, cancellation or endorsement of any license or permit or the disqualification in respect of any license or permit is permissible or prescribed; or
 - v. of any person convicted by a court ...
 - b. make a person referred to in paragraph (a) (i) or (ii) available ... for identification in such condition, position or apparel as the police may determine
 - c. take such steps as he may deem

necessary in order to ascertain whether the body of any person referred to in paragraph (a) (i) or (ii) has any mark, characteristic or distinguishing feature or shows any condition or appearance

d. take a photograph or cause a photograph to be taken of a person referred to in paragraph (a) (i) or (ii).

2.

a. Any medical officer of any prison or any district surgeon or, if requested thereto by any police official, any registered medical practitioner or registered nurse may take such steps, including the taking of a blood sample, as may be deemed necessary in order to ascertain whether the body of any person referred to in paragraph (a) (i) or (ii) of subsection (1) has any mark, characteristic or distinguishing feature or shows any condition or appearance.

b. If any registered medical practitioner attached to any hospital is on reasonable grounds of opinion that the contents of the blood of any person admitted to such hospital for medical attention or treatment may be relevant at any later criminal proceedings, such medical practitioner may take a blood sample of such person or cause such sample to be taken”.

to remove a bullet from an individual, where ballistic analysis thereof could contribute to the criminal investigation. The unique DNA of a given individual can therefore be regarded as a “characteristic” or “distinguishing feature”, of that person.

The necessary steps referred to in (c) above include the instruction to a doctor or nurse by means of a completed SAP 308 (a) to collect the necessary blood and other biological samples needed for the investigation. In the case of *S v Maqhina* 2001 (1) SACR 241 (T) it was decided that where the State’s proof of the accused’s guilt depended on the results of scientific analysis, the *testing process*, including the control measures applied, had to be executed and recorded with such care that at any time later it could be *verified by any objective scientist*.

Where specialised investigations are performed, it is the duty of the laboratory and/or scientists involved to ensure that the analysis will stand the admissibility test in court. Molecular biological investigations (DNA fingerprinting) are complex and labour intensive, and require advanced statistical methodology in their interpretations and applications in court proceedings. As DNA analysis is very expensive (± R1 200 per sample), only examinations specifically requested by the prosecutor during/before a court case are performed, taking up to 12 weeks to get a result. This should, however, not preclude the medical practitioner from harvesting the appropriate samples when necessary, since in most cases these samples can be effectively stored (at the laboratory) until analysis needs to be performed.

In addition to the existing large SAPS Forensic Science Laboratory in Pretoria, as well as a number of regional laboratories, the establishment of a fully automated, state-of-the-art laboratory for DNA analysis of blood samples is at an advanced stage. This new laboratory includes a Laboratory Information Management System (LIMS) and is coupled with the new generation of Crime Evidence Collection Kits currently available in South Africa. Costs and efficiency of DNA testing in the new laboratory will

be significantly improved, while the number of samples analysed will dramatically increase. The possible implementation of a national DNA-“fingerprint” database by the SAPS, similar to the conventional fingerprint database, is currently being investigated and may play an important role in future justice administration. Clearly, ethical and legal issues in this regard require substantial consideration.

IDENTIFYING AND COLLECTING PHYSICAL EVIDENCE: THE ROLE OF MEDICAL PRACTITIONERS AND OTHER HEALTH CARE WORKERS

In order for medical professionals to play their part in reducing and preventing crime, they have to know and understand current investigative methods and techniques. In any crime where physical contact and/or injury has occurred, the crime scene can be divided into several categories, including:

1. The actual physical setting or “stage” where the crime occurred.

This would include the room, vehicle or outside location where the contact between victim, weapon and assailant occurred. The investigating officer/crime scene technician has to detect and collect fluid and/or tissue specimens and other evidence from this crime scene. This source includes the clothing of both victim and perpetrator and any relevant foreign material, objects and weapons.

2. All external and internal bodily surfaces of victim and assailant, especially mouth, anus, genital area and vagina in cases of sexual assault.

It is the responsibility of the medical examiner to collect the evidence in the latter category, bearing in mind that items such as clothing are an integral part of the person of the victim/perpetrator. Nursing professionals and emergency care personnel should also be well informed of these responsibilities, as they are often the first line of contact with such patients and may be responsible for removing articles of

It is clear that the law gives the courts, the police and medical practitioners substantial powers in order for physical examination, as well as special investigations, to be performed on persons suspected of having been involved in criminal activities. In particular, medical practitioners need to be aware of these legal responsibilities and obligations, and that the rights of the “patient” may indeed sometimes be superseded by the rights of society. Recent court decisions have upheld the right of the State to procure biological samples from individuals, including blood and/or saliva samples for DNA analysis, as well as surgical intervention

clothing which may contain vital evidentiary matter.

It is the duty of every professional, both in the public and private sectors, to be aware of the potential legal importance of biological and other evidence present on victims and perpetrators of crime and to collect and preserve this evidence, irrespective of the availability of crime kits and police involvement.

In the absence of a crime kit, evidence can be collected by means of standard throat swabs, blood specimen collection tubes, paper sheets and envelopes, paper bags or X-ray envelopes. In this case, all items must be clearly marked with the patient's name, address, ID number or date of birth and details of practitioner and

stored in a safe, locked area, until a police investigation has been confirmed.

Despite time constraints, clinicians should realise that a few extra minutes spent in adhering to standard protocols, good documentation of findings and the proper acquisition of specimens will save colleagues hours in future travelling and court time. More importantly, perhaps, save many hours in criminal investigation and prosecution resources.

Although there are numerous sources of trace evidence as mentioned above, it is perhaps in the field of molecular biology that the most varied specimen/sample origin lies. It is thus relevant that practitioners be informed of some of the possible sources and settings from which material for DNA analysis can be

obtained. *See Table 1.*

A new series of evidence collection kits was recently designed and implemented in South Africa. The purpose of these kits in the collection of evidence in a manner that complies with all the latest legal and scientific specifications. The "Sexual Assault Examination Kit" (SAEK[®]) which forms part of these kits is regarded as one of the best of its kind currently available.

Included in the kits is a barcoded consent form to be completed by the medical examiner and signed by the patient, as well as clear instructions with detailed sketches for each step. All items are barcoded with a unique number that remains the same through all steps in the investigation, thus preserving the chain of evidence. Specimen containers

Table 1: Examples of evidence collected for DNA examination

Evidence	Possible location of DNA evidence	Source of DNA	Crime
Knife, bat or similar weapon	Handle, blade, end	Sweat, skin, blood, tissue	Violent crimes like assault, murder, house-breaking, malicious injury to property
Hat, bandana, mask or balaclava	Inside	Sweat, hair, dandruff	Any crime
Eyeglasses	Nose or ear pieces, lens	Sweat, skin, hair	Any crime
Facial tissue, cotton swab	Surface area	Mucus, blood, sweat, semen, ear wax	Any crime
Dirty laundry	Surface area	Blood, sweat, semen	Violent crimes: murder and rape
Toothpick	Tips	Saliva	Any crime in which the suspect helped him/herself from the kitchen: murder, rape, housebreaking
Used cigarette	Cigarette butt	Saliva	Any crime
Stamp or envelope	Licked area	Saliva	Extortion, fraud, intimidation
Tape or ligature	Inside/outside surface	Skin, sweat	Theft, housebreaking
Bottle, can or glass	Sides, mouthpiece	Saliva, sweat	Crimes in which the suspect helped him/herself from the kitchen or fridge, or where alcohol was involved.
Used condom	Inside/outside surface	Semen, vaginal or rectal cells	Rape, murder
Blanket, pillow, sheet	Surface area	Sweat, hair, semen, urine, saliva	Murder, rape
"Through and through" bullet	Outside surface	Blood, tissue	Murder, attempted murder
Bite mark	Person's skin or clothing	Saliva	Rape, assault
Fingernail, partial fingernail	Scrapings	Blood, sweat, tissue	Murder, rape, assault

are designed to allow for air drying of all specimens and are sealed with tamperproof seals provided in the kit.

GENERAL CONSIDERATIONS AND GUIDELINES IN COLLECTING BIOLOGICAL EVIDENCE

- The first contact with a health professional may be the only opportunity ever to capture valuable evidence. Evidence not obtained at this occasion is most likely lost forever.
- Explain the need for collecting the evidence to the patient, and obtain informed consent.
- Discuss with the victim the logistics and implications of making the evidence available for police investigation.
- In cases of alleged sexual assault, it remains the choice of the victim to lay charges.
- All gunshot incidents should be reported to the police and all projectiles must be collected, sealed in an envelope and handed over to the police, irrespective of the patient's decision.
- Never cut through evidence on the patient's clothing when removing clothes for treatment purposes. Air dry and put in a large paper bag, cardboard box or X-ray envelope.
- Items of clothing are not only important in cases of alleged sexual assault. Smoke or soot deposition in cases of gunshot wounds may be crucial in assessing the nature of the weapon or ammunition used and the distance from which the weapon was fired.
- Never store any biological evidence in plastic containers. Specimens must be allowed to air dry, to prevent decay and bacterial contamination.
- When collecting trace evidence, the examiner must always wear a clean pair of disposable gloves to prevent specimen contamination with his/her own DNA.
- If ordinary throat swabs are used, the plug at the closed end must be removed or the tube cut open.
- Hair samples and biological foreign material (grass, dirt) can be

collected on a sheet of paper and sealed in a paper envelope.

- Glass slides with oral, vaginal and semen swab smears are no longer examined by the Forensic Science Laboratory.
- Reference semen and saliva specimens are not needed for forensic purposes.
- All necessary reference DNA specimens are collected by means of venous blood from the victim or perpetrator/accused and must be collected in an EDTA (orange cap) specimen tube.
- Never use KY™jelly prior to collecting genital and anal swabs, as the glycerine interferes with the reagents used in the PCR method for identifying DNA from a specimen.
- The specimens are collected routinely in all cases of sexual assault, irrespective of ejaculation, presence of condom or foreign object penetration.
- In case of a young child or a virgin, only the external genitalia and hymen are swabbed.
- Vaginal swabs must be taken irrespective of washing, douching and bathing up to 5 to 7 days after the alleged sexual assault.
- Specimens from the genital area must be collected in the following sequence: external anal area first (as semen and ejaculate will collect in this area, irrespective of anal assault having occurred); next, external genitalia, especially the fold between the labia majora and labia minora; then the vagina, especially the posterior fornix and finally, the external os of the cervix.
- Reference DNA specimen: Blood from the victim must always be taken in order to have a DNA profile available against which to compare DNA from all other specimens obtained. Reference blood must also be obtained from the alleged perpetrator as well as any person with whom the victim had consensual vaginal or anal intercourse during a three- to five-day period prior to the assault. Blood is collected on a so-called "Marshall Cassette[®]", which was especially designed in South Africa to comply with the needs of

the new, automated Forensic Science Laboratory.

- Blood samples should be taken for toxicological screening where appropriate, not only for alcohol, but also for drugs of abuse and possible "date rape" drugs (eg. flunitrazepam). The use of urine samples in this regard should also be considered.
- The blood collection tube along with the pamphlet inserts and plastic packaging material are the only items that can be discarded by the doctor and not returned to the kit. All other specimen containers and any bar coded items, whether used or not must be returned to the kit before sealing. Using "leftovers" from one kit for a subsequent client can be disastrous and have serious legal and ethical consequences.
- All evidence collection kits must be handed to the investigating officer, who has to sign for receipt on the J88 or patient file. Evidence may never be given to the patient, parent or other party.

CONCLUSION

All health professionals must be aware of their obligations to *both* their patients and society when dealing with victims and perpetrators of crime. The application of science in identifying crime and prosecuting the guilty has expanded greatly over the past few decades. Good clinical examination and documentation of findings, together with scientific and objective evidence correctly obtained, can be powerful aids in helping to convict the guilty and clearing the innocent. Health professionals in South Africa should accept these responsibilities and use their knowledge and skills to contribute towards an efficient justice administration system. Fear of having to testify in court, not being appointed as a "District Surgeon" or lack of training are inadequate reasons for health professionals not to fulfil their ethical and legal obligations when performing clinical forensic medical duties. □

Please refer to the CPD questionnaire on page 53.