The evaluation of the specificity of the Acid Phosphatase Test to identify semen

Robyn Conrad

Division of Forensic Medicine and Toxicology, University of Cape Town

The burden of sexual assault cases in South Africa is exceptionally high, with 51,895 cases reported nationwide between April 2015 and March 2016. The analysis of biological material in sexual offence cases may provide evidence towards a criminal investigation. These analyses include the identification of biological material to: (i) presumptively identify if semen may be present in order to guide downstream DNA profiling analysis to identify the alleged assailant; and (ii) confirm if semen was indeed present to provide evidence of ejaculation. The presumptive used to detect the possible presence of semen is the Brentamine Fast Blue test, which detects the presence of acid phosphatase (AP, an enzyme that is present in semen in high concentrations. However, this method relies on a subjective colour change reaction and cannot differentiate between animal and human semen. The specificity of the Brentamine Fast Blue test was therefore explored in this study, by objectively measuring the enzyme kinetics of semen and comparing the time taken for a positive reaction to occur in both human and animal semen samples. Semen samples included in this study were from: humans (n=10), dogs (n=11), ostriches (n=12), and rams (n=12). The objective measurements were achieved through measuring the kinetic activity of the AP enzyme using an Ultraviolet Visual (UV-Vis) spectrophotometer to detect the rate of the colour change reaction at a specific wavelength. Differences in reaction rates were observed between animal species and humans, and thus may provide an alternative way with which the presumptive testing of semen is examined. The potential value regarding the ability to specify evidence is of human origin will increase the evidential value of such results, and may aid in downstream DNA profiling.

Success rate of forensic DNA profiles obtained from buccal swab and blood samples collected from deceased infants at Salt River Mortuary (Western Cape, South Africa)

Kate Reid

Division of Forensic Medicine and Toxicology, University of Cape Town

Background: Every year, more than 300 individuals (10% total case load) remain unidentified following post-mortem investigation at Salt River Mortuary, with a significant proportion having demise following violent altercations, including abandonment in the case of neonates. In such instances forensic DNA profiling is required for human identification. In South Africa, the Whatman® EasiCollect™ device is routinely used to collect buccal cells from living individuals for the generation of a forensic DNA profile. This device is not always a feasible option to collect DNA from deceased individuals, particularly infants, as the device is too large to fit inside the infant’s mouth. Alternative swab types exist, and one cheaper and smaller option is a cotton swab. The use of such swabs has not yet been investigated in deceased infants.

Aim: To investigate the use of a cotton swab to collect buccal cells from deceased infants and assess the forensic DNA profiles produced.
**Methods:** Thirty-eight deceased infants were included in the pilot study, who were examined at Salt River Mortuary between 1 March 2016 and 10 June 2016. Buccal cells (cotton swab) and blood were obtained during autopsy and processed using the **PowerPlex® ESI 16 System (Promega).**

**Results:** Full forensic DNA profiles were obtained for 100% infants from DNA extracted from blood. Using the same protocol, DNA extracted from buccal swabs only yielded full forensic DNA profiles for 32% of infants. Optimising the protocol, saw a 2.6-fold increase in success rate, with full forensic DNA profiles obtained for 84% infants. A partial profile was significantly associated with the degradation of the DNA from cotton swabs (p<0.001), but not with time interval between death and DNA extraction (p=0.93). These results show that full forensic DNA profiles can be obtained from buccal cells via cotton swab. However, in medico-legal cases where the Whatman® EasiCollect™ device is not feasible to use, blood, should be preferentially obtained for forensic DNA profiling. Nevertheless, these results indicate the value of DNA profiling in identifying individuals and aiding criminal investigations.

**Exploring genetic variation in the CYP2D6 gene in drug intoxication cases at Salt River Mortuary**

**Devin Vincent**

*Division of Forensic Medicine and Toxicology, University of Cape Town*

Drug use is a major burden in Cape Town, South Africa, and at times may be fatal. Individuals suspected to have demised from drug intoxication are referred for medico-legal investigation, in order for cause of death to be determined. Sometimes, it remains ambiguous as to whether the drug intoxication was suicidal or accidental, even after a full post-mortem examination. Literature has shown that molecular analysis of genetic variants in genes encoding for drug metabolising enzymes may provide insight into the manner of death. At Cape Town’s Salt River Mortuary, numerous toxicological-related cases yield ambiguous results, which may potentially be resolved with molecular analyses. However, no optimised molecular assay to sequence drug metabolising enzymes currently exists in a local context. The aim of this project was to design and optimise a molecular-based assay to sequence the drug metabolising enzyme, CYP2D6. Subsequent to primer design, exons in **CYP2D6** were amplified and sequenced. The optimised assay was then applied to DNA from two decedents suspected to have demised from drug intoxication. Following a toxicological drug screen, certain drugs metabolised by **CYP2D6** were reported. The assay revealed genetic variants within **CYP2D6**; with the haplotypes confirming an overall intermediate (altered) or extensive (normal) metaboliser phenotype in case 1 and an intermediate metaboliser of specific drugs, in case 2. The genetic variants, combined with the presence of these drugs in each case, suggests altered drug metabolism, which should be investigated further and interpreted within each case context. These findings would also be beneficial to the decedents’ living relatives, who may also carry these variants. Overall, this study demonstrates the value of molecular analyses in forensic investigations of toxicological-related fatalities, and lays the foundation for additional future research, particularly since the molecular assay has now been successfully optimised.
A Snapshot of homicides in Cape Town

Bronwen Davies

Division of Forensic Medicine and Toxicology, University of Cape Town

South Africa (SA) has a multi-faceted history of violence, with one of the highest rates of injury-related deaths in the world [1,2]. A recent study on injury-related mortality indicated that homicide was the leading manner of death (38.4 per 100,000 population) in SA in 2009, and that males were 6 times more likely to be victims of homicide than females [3]. This study aimed to investigate the prevalence and characteristics of homicides in young individuals in the West Metropole of Cape Town (CT).

A retrospective descriptive study was conducted on victims of suspected homicide aged 10-24, who were admitted to Salt River Mortuary (SRM) in CT over a period of five years (2011-2015). Data were obtained from post-mortem reports and ancillary medico-legal documents.

Homicides made up 33% (n=5486) of total cases admitted to SRM between 2011 and 2015 (n=16,451). Of these homicides, 32% (n=1734) were victims aged 10 through 24, with an average male-to-female ratio of approximately 15 to 1. The numbers of homicide victims aged 10 to 24 increased over the five years and were consistently higher in young adults (e.g. aged 21-24). Decedents were mostly Black Africans (n=1086; 62%) and Coloureds (n=640; 37%), with <1% of White and Asian victims reported. The major causes of death were gunshot wounds (n=742; 43%), stabbings (n=706; 41%), and blunt-force assaults (n=217; 12%). While stabbings and assaults remained consistent in number, an increase in gunshot wound deaths was observed (33% of homicides in 2011 to approximately 51% in 2015).

It is evident that homicide remains a large burden on the South African society and community safety. This study indicated that approximately one-third of homicides in Cape Town occur within this young age group, and that males were the dominant victims, particularly of firearm and sharp force-related death.

References: