D7 The Effectiveness of Overt and Covert Protection Against Attacks by Sharp Implements

Sarah V. Hainsworth, PhD, Aston University, Birmingham B4 7RT, UNITED KINGDOM; Patrick H. Geoghegan, PhD, Aston University, Birmingham B4 7ET, UNITED KINGDOM*

Learning Overview: After attending this presentation, attendees will understand how weapon profile affects the penetration ability of knives and spikes in stabbing and slashing attacks against body armor and slash hoodies.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating how overt and covert protection performs against attacks from knives, shivs or spikes, and other sharp implements.

Kevlar® is commonly used in body armor to protect against stab, slash, and spike attacks. Unlike ballistic attacks, attacks with edged and spiked weapons usually occur with the assailant and intended victim in close proximity to each other (unless the weapon is thrown). Stab/slash vests and clothing are therefore commonly worn by police officers, prison officers, security guards, and doormen. Kevlar® armors are typically lightweight in comparison to other body armors so the vests can be worn for long periods without undue fatigue or drop-off in performance of the wearer. Kevlar® vests can have both stab and spike ratings and protect against weapons such as knives, broken bottles, and syringes, for example. In prisons for example, protection is required from homemade weapons or "shivs."

Protection for individuals can be in the form of stab-resistant protection worn over clothing (overt protection) or panels worn under normal clothing (covert protection). A range of different types of clothing with Kevlar® in the weave of the clothing is also available from hoodies to sweaters and T-shirts. There are a number of standards available for body armor. Commercially available clothing usually complies to the National Institute of Justice (NIJ) Level 1 stab and spike resistance (CAST/HOSDB KR1 and SP1). However, composite manufacturers and other protective materials are continuously developing new materials that offer new protection mechanisms.

The goal of this research is to show how weapon geometry interacts with stab-proof materials using high-speed video testing of attacks by sharp implements and subsequent analysis of fabric damage using microscopy. The outcomes will be used in collaboration with manufacturers of anti-stab clothing to show how performance of these materials and clothing can be improved. The stab-resistant clothing and protection will be contrasted with tests against ordinary fabrics. The tests show for a range of weapon types how a stab vest worn over clothing, a covert anti-stab panel, a slash hoodie, and a long- sleeve T-shirt perform in response to penetration by a weapon. The forces generated during the stab attacks will be recorded using an instrumented knife and a dynamometer. By understanding the exact mechanisms of damage to the materials and how the implements penetrate through the material, this study will be able to inform the development of stab-proof vests and clothing and allow improved personal protective equipment to be developed.

The results show that knives generally penetrate the fiber network by cutting through the individual fibers but that shivs and other pointed instruments penetrate through the fiber network and, therefore, differing strategies are required for providing protection for different weapons.

The results are discussed in terms of the way in which these insights can inform the future development of body armor.

Stabbing, Body Armor, Knives