CASE REPORT

Jane Moira Taupin,[1] *M.A.*

Arrow Damage to Textiles—Analysis of Clothing and Bedding in Two Cases of Crossbow Deaths

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ABSTRACT: Two cases of crossbow deaths involving analysis of damage to clothing and bedding are described. The distinctive characteristics of the damage examined in these cases indicate that there is merit in examining damage to clothing as well as wounds to the body in crossbow injuries. Clothing damage analysis may be especially useful if the body is badly decomposed or never recovered. Furthermore, damage to textiles may reflect a clearer geometry of the weapon than that of the associated wounding.

KEYWORDS: forensic science, criminalistics, crossbows, arrow wounds, damage, clothing, textiles

The crossbow arrow is rarely encountered as a weapon in forensic cases (1–3). Concern has been expressed that the injuries may be confused with gunshot injuries should the weapon be absent at the time the body is discovered (3,4). If the body is badly decomposed or missing altogether, then there may be limited or no information from injuries as to the cause of death.

Damage to textiles such as clothing is commonly encountered in serious crimes of violence such as homicide and rape, and forms a significant part of biology casework in Victoria (5). Characteristics of the damage may provide valuable information as to the possible implement causing that damage (5,6). This examination is particularly useful when 'unusual' weapons which produce distinctive characteristics may be involved.

This report describes two recent cases examined at this laboratory in which a crossbow arrow was believed to have been the cause of death. The first case involved an arrow located in a dismembered human torso and the analysis of damage to the associated upper body garment. Information gained from this case was utilized in the second case in which the body was never found but suspected crossbow arrow damage to bedding was examined.

Case Reports

Case 1 (7)

A man was strolling along the shores of a Victorian beach in July 1989 when he saw his dog pawing a putrid smelling package.

[1]Forensic Scientist, Victoria Forensic Science Center, Victoria Police, Forensic Drive, Macleod, Victoria, Australia.

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FIG. 1—*Human torso excavated from beach.*

He notified the local police who unearthed a tarpaulin covering a human torso (Fig. 1). The following day a further package was located in nearby bushland containing two severed hands, two feet and a severed head. In addition to the body parts were a tie, a shirt and a pair of underpants (Fig. 2). The legs and remaining clothing were never recovered. The autopsy revealed a single puncture

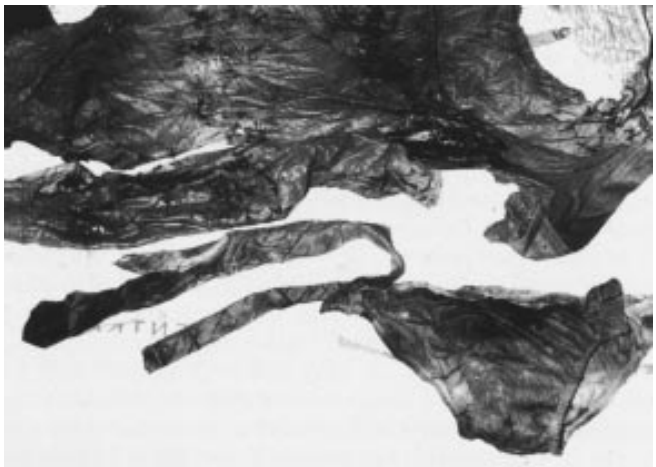

FIG. 2—*Clothing located in second package.*

wound to the chest containing a hunting (broadhead) arrow with a broken shaft.

Identification of the deceased was based on forensic odontological examination of the jaw. The arms of the shirt and the right front panel were severed, and there was damage in the shirt in the area approximating the wound to the chest. The buttons down the front of the shirt, including the front of the collar, were fastened. There were cuts severing the loop of the tie and the legs of the underpants. It was considered likely that the arrow which pierced the right ventricle of the heart was the cause of death. It was also considered likely that a sharp instrument such as a band saw was used to decapitate and dismember the body.

Case 2 (8)

A middle aged man went missing from his Melbourne home in late 1983. It was not until 10 years later that it was alleged that his son, 17-years-old at the time, had murdered his father after an argument. The son had allegedly boasted to friends that he had fired an arrow from a crossbow into his father's stomach and buried the body. After 18 months he then dug up the body with the assistance of a friend, burnt the remains and threw the remaining crushed bones into a local river. During the trial a previous girlfriend of the accused alleged he had fired the crossbow into her bed some months previously, warning her that a fate which befell his father may happen to her unless she was more obedient. The bedding was brought into the laboratory for examination and comparison with a hunting type arrow.

Methods

The damage was first examined macroscopically at the fabric level. The fabric construction and composition were noted, namely a weave in all cases. The degree of 'wear and tear' in the materials was also described. The damage was then examined microscopically at the yarn and fiber level using a WILD M650 stereomicroscope varying to 40 times magnification. Points such as planar array and distortion were noted (6,9).

Simulation experiments (5,9) were performed by manually thrusting the reference arrows into the respective damaged bedding from Case 2 and a purchased shirt similar in fabric to that damaged in Case 1. The resulting simulation damage was then compared macroscopically and microscopically to the 'crime' damage.

Results

There was a 'Y'-shaped cut in the right front panel of the shirt from Case 1, with arms approximately 1.5 cm in length separated by equal angles of approximately 120° (Fig. 3). The arrow removed from the body had a metal tri-bladed head (Fig. 4). Tri-bladed hunting arrows similar to that recovered from the body, as well as a crossbow, were subsequently located and associated to the suspect, a former business associate of the deceased.

In Case 2 there were two 'Y'-shaped cuts detected in a pillow case, with arm lengths of approximately 1.2 cm separated by equal angles of approximately 120° (Fig. 5). Two similar 'Y'-shaped cuts were detected in an electric blanket; one had arms approximately 0.6 cm in length, the other with arms approximately 1.1 cm in length (Fig. 6). A crossbow arrow with a tri-bladed hunting, or broadhead, type arrow was provided as the suspect weapon.

The damage examined was assessed as cuts due to the presence of planar arrays in the severed edges, the relatively featureless

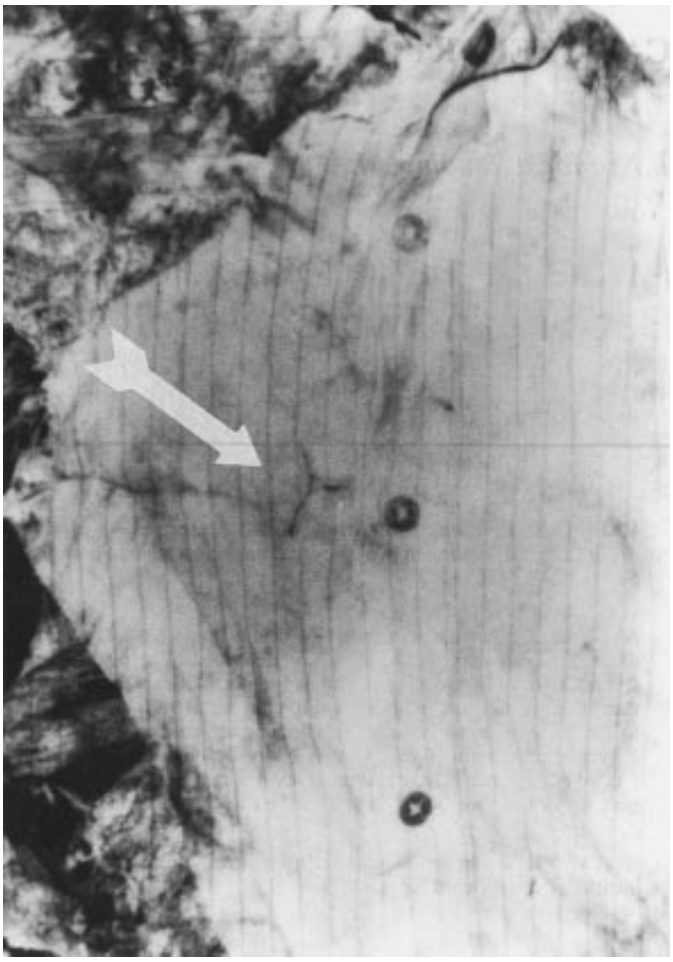

FIG. 3—*'Y'-shaped cut in right front panel of shirt.*

severed edges and the fact there was no preferred direction in any of the 'Y'-shaped severances from the three articles.

The distinctive cuts to the shirt were readily associated with the arrow in the corresponding position of the torso and clearly reflected that arrow's geometry. Characteristics of the cuts to the pillow case indicated that they were not 'recent'; that is, since the last wash. The presence of foreign fibers and pilling on the severed fiber ends and some matting of the fiber ends indicated the damage was 'old.' This was not surprising as the pillow case would be expected to be washed more frequently than the electric blanket. Again, distinctive cuts were noted in this bedding.

Simulation experiments with the provided 'reference' arrows in the purchased shirt, the pillow case and electric blanket produced characteristics similar in macroscopic and microscopic appearance

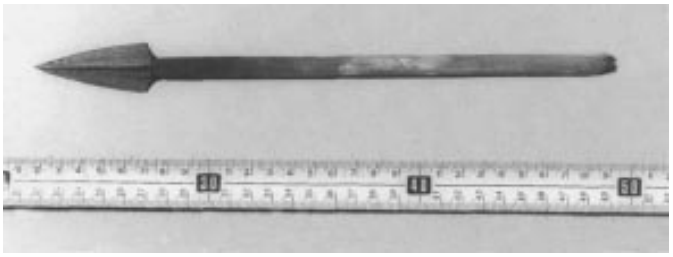

FIG. 4—*Arrow removed from torso.*

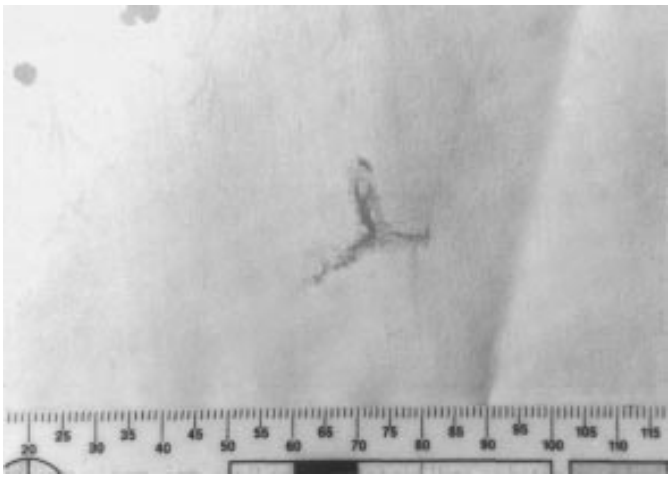

FIG. 5—*'Y'-shaped cut in pillow case.*

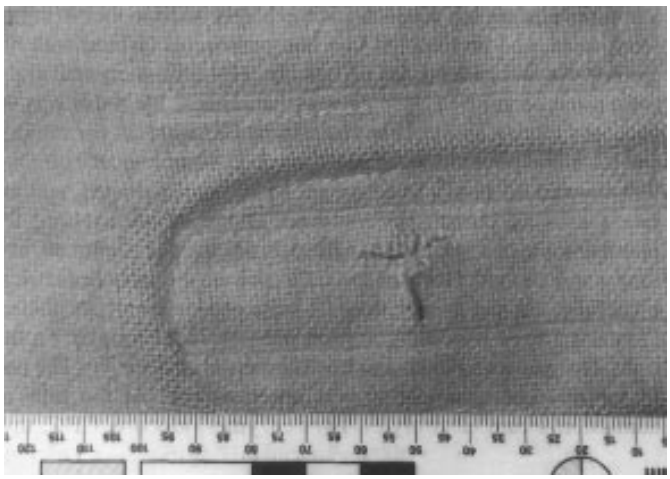

FIG. 6—*'Y'-shaped cut in electric blanket.*

to the 'crime' damage. While the angles remained constant, the 'arm' lengths varied according to the depth of penetration of the arrow. It was concluded in each case that the provided arrow, or one similar, may have caused the damage.

Discussion

The most common arrowheads are field tip (or target) and broadhead (or hunting) (1). The field tip is conical and usually metal. The broadhead has multiple razor sharp metal vanes attached to the tip. In both the case studies a broadhead arrow was considered as the most likely to have inflicted the observed damage/wounds. The array of metal vanes in this type of arrow produces a characteristic defect in textiles which corresponds to the arrowhead's geometry. The simulations and distinctive 'Y'-shaped cut produced in the shirt could be associated with the arrow 'in situ' in Case 1. It was thus considered likely that dismembering of the body and subsequent removal of the clothing took place after death. A fingerprint of the suspect was found on the tape binding the package containing the torso. The suspect was found guilty of murder at the trial and was sentenced to twenty years jail.

The findings of Case 1 were used in the analysis of Case 2. The distinctive cuts to the bedding supported the veracity of the claims of the ex-girlfriend. The son of the deceased was found guilty of murder at the trial and sentenced to a minimum of fourteen years jail.

Although the two types of arrowheads may produce characteristic wounds (2–4), both types cause injuries which could be misinterpreted by the examiner should the arrow be absent at the time the body is discovered (4). The distinctive characteristics of damage examined in these two case studies suggest that on occasions textile damage may be a clearer reflection of the weapon's geometry than body wounds. While only broadhead arrows were examined, and field tip arrows have fewer distinctive characteristics, it is predicted that clothing analysis may still be useful when field tip arrows are suspected. Arrow wounds and gunshot wounds to the body may also be differentiated chemically (3). Examination of the clothing for evidence of powder/projectile residue may also assist in the differentiation of the type of weapon used.

While manual thrusts were used in these simulation experiments, on occasions the velocity of the suspected weapon may need to be more closely approximated. For example, actual test firings from a crossbow may be necessary when simulating field tip arrow damage, where fewer outstanding characteristics may be observed.

It should be noted, however, that simulation experiments can never be a reenactment of the crime. Variables such as movement and position of the body and velocity of the weapon are often unknown, so caution must be exercised in any interpretation. The textile damage examiner should be aware of possible alternatives: knife cuts through folds may mimic arrow damage for example. Also, due to weapons being mass produced, the probability of a particular weapon causing the damage cannot be determined.

Nevertheless, this study shows that damage analysis to clothing and textiles may give valuable support to testimony, especially in the absence of corroboration from wound analysis.

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Additional information and reprints requests:
Jane Moira Taupin
Victoria Forensic Science Center
Victoria Police
Forensic Drive
Macleod, Victoria
Australia 3085