J Forensic Sci, Jul. 1978, Vol. 23, No. 3

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Embalming Artifacts

Exacting accuracy is a necessity for the forensic scientist, but that accuracy becomes a challenge when the scientist is faced with common or unusual mortuary procedures that have simulated or disguised antemortem conditions of the body. The forensic scientist can spend many difficult hours attempting to correctly interpret the postmortem insult if he is not familiar with techniques used by morticians in the preparation of a body for burial. Should the condition of the body be incorrectly analyzed, the result could be the acquittal of a person guilty of murder, or worse, the conviction of an innocent person.

The injection of embalming fluids, aspiration of blood from the body cavities, sanitization of the body, and application of cosmetics have been shown to (1) simulate injury and disease to the head, heart, and lungs; (2) mask facial and head injuries; (3) alter surgical procedures and wounds; and (4) eradicate trace evidence and postmortem changes.

Autopsies on embalmed bodies require an extra degree of awareness that should be enhanced by a familiarity with mortuary methods.

Embalming Techniques

> Embalming is a process in which the application of various chemical agents to the interior and exterior tissues of a dead body [retards tissue decomposition and] creates and maintains a natural, lifelike appearance for the necessary period of time. ...Actually, it is the surface appearance—the "cosmetic effect"—rather than the tissue preservation itself that makes embalming an important and necessary part of the modern American way of life [*1*].

Steps in the preparation of the exterior body for embalming are as follows: removing the clothing, shampooing and shaving the hair, cleaning the body, and then applying cosmetics and positioning the body for the casket. The preparation of the internal tissues requires the intraarterial injection of embalming fluids as well as the closing of the eyelids with eyecaps and the mouth with wire.

The abdominal and thoracic cavities are injected with embalming fluid or, if the body has been autopsied, hardening compound is added. If the head has been explored in an autopsy, the basilar skull and foramen magnum are filled with absorbent material and sealing material.

Any of these techniques can produce artifacts or eradicate evidence. The following discussion details these techniques and describes the artifacts encountered.

Removal of Clothing

Defects in the clothing assist in verifying the number of wounds. The direction of the fibers may differentiate an entrance from an exit wound. Soot and powder deposits estab-

Presented at the 29th Annual Meeting of the American Academy of Forensic Sciences, San Diego, Calif., 15-19 Feb. 1977. Received for publication 15 Sept. 1977; revised manuscript received 1 Dec. 1977; accepted for publication 3 Dec. 1977.

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lish the muzzle distance from the wound. The clothing may clarify whether the wound is actually a gunshot wound. The clothing may contain loose bullets, jackets, or fragments of bullets. Removing shoes, unfastening belts, and opening zippers and buttons can obscure evidence of the direction of a graze wound. The unsupervised, improper removal of the clothing can confuse the interpretation of any wound. The clothing may have been worn incorrectly (for example, inside out or backwards) or may have been removed from and then replaced on the victim. The embalmer often cuts and tears the clothing while undressing the body.

Trace evidence may be lost or contaminated by improper removal of the clothing. Bloodstains from a suspect may be contaminated with the victim's blood. Fragments of glass and paint may be lost with the removal of the clothing. Electrical burns on the clothing may be the only external evidence of electrocution.

In addition to the clothing, the embalmer removes ligatures and nooses from about the neck to allow for adequate circulation of the embalming fluid to the head. Bandages, drains, and plaster casts are removed. Bandages may help determine the nature of the drainage, that is, purulent or hemorrhagic. Pacemaker wires are removed, and therefore their proper placement cannot be determined.

Finally, the manipulation of the body during the removal of the clothing alters the rigidity and may result in a postmortem fracture, particularly in elderly individuals.

Shaving and Shampooing

Shaving the face will frequently create small abrasions over the neck and mouth. These may be confused with the markings of manual strangulation or suffocation and may also simulate ant or insect activity on the face. The shave abrasions usually have a characteristic yellow parchment-like postmortem appearance. The shampoo and styling may cover a small gunshot wound, particularly in the Afro-style haircut. Larger wounds may be sutured and the hair combed over the wound. Soot, powder, and trace evidence can be destroyed.

Cleansing

The mouth, nose, and ears are cleaned of any blood and plugged with cotton to insure against seepage, and thus a clue to hemoptysis, hematemesis, or skull fracture may be lost. Spinal fluid seeping from the ear would be obstructed. Detergents and deodorants are applied. Maggots are killed with kerosene, gasoline, ether, and chlorofrom. Any of these procedures may destroy toxicological evidence pertinent to the cause of death and cause a safety hazard to the examiners [2].

The hands and fingernails as well as the face receive special attention because they will be visible in the casket. A manicure will remove trace evidence such as hair or skin underneath the nails. The hands are washed of soot, powder, grease, and blood. Cleaning the remainder of the body will wash extraneous pubic hairs, fragments of glass, paint, or blood down the drain.

Applying Cosmetics

Creams, powders, waxes, and petrolatum are used to cover any markings that may detract from the lifelike appearance. These are applied heavily over the face and hands. Petechiae on the face and superficial contusions and abrasions of the neck and hands are covered with relative ease. Large lacerations, contusions, and abrasions can be disguised. Eyelids, ears, nose, and lips are reconstructed in wax to restore appearance prior to injury.

A gunshot wound to the head is plugged with wax and cosmetics are applied. Gunshot wounds to the body are sealed with trocar buttons, threaded plastic cone-shaped plugs used to prevent the escape of fluids to the clothing or casket lining.

Hesitation marks, scars on the wrist, and defense wounds of the hands may be repaired and covered with cosmetics. Faces and hands discolored from lividity, Tardieu's spots, contusions, jaundice, or any type of discoloration may be bleached. Cavity fluid packs, phenol solution, or many other commercial preparations are available for this purpose. Periorbital ecchymoses are subjected to hypodermic injection of bleaching agents.

Embalming Fluid

There are special embalming fluids that aid in the decolorization of jaundice or contain eosin and other dyes to restore a more natural color. A combination of embalming fluid dyes and special lighting in the funeral home help enhance a lifelike appearance of the body. Unfortunately, the red dyes stain the gastric mucosa and simulate an overdose of red, encapsulated secobarbital. The bright red appearance of some bodies simulates carbon monoxide or cyanide poisoning. Cyanides are not detectable after embalming and formalin-fixed tissues are difficult to process for toxicology. It is recommended that a sample of the embalming fluid be obtained for use as a control if a positive finding is encountered during autopsy [*3*]. Perfumed embalming fluids disguise characteristic odors of cyanide, diabetic ketosis, or certain ingested drugs.

The quantitation of blood ethanol is impossible once embalming fluid has been injected. The reliable quantitation of alcohol from vitreous humor after embalming has been reported [*4,5*].

Arterial Injection

The usual sites for injection of embalming fluids are the carotid, femoral, and brachial arteries. The embalmer may select the site for injection at a previous laceration or incision and then neatly approximate the injury. The fluid is injected under a variable degree of pressure. Motorized injections vary from 34 kPa (5 psi) to more than 340 kPa (50 psi) wih pulsating equipment.

The pressure injection into carotid arteries often causes postmortem blood to extravasate into the surrounding neck structures and tissue. This postmortem hematoma can seriously interfere with the assessment of neck injury, whether it be a fracture of the cervical spine, hyoid bone, or thyroid cartilage. In attempts by the embalmer to remove clots from the superior vena cava, the extractor enters the right atria and the inferior vena cava. There are frequent injuries to these tissues and some perforations may produce artifactual cardiac tamponade.

Forceful probing in the neck area can result in the introduction of embalming fluid into the trachea, lungs, thoracic cavity, esophagus, and stomach.

The injection of fluids under pressure may cause dissection of aneurysms. Blood volume determinations in the serous cavities are useless since fluid escapes into the cavities by way of disrupted vessels.

Contusions are artifactually enhanced by arterial embalming, and photographs may be disallowed by courts properly considering this as an alteration. This accentuation of contusions has been attributed [*2*] to

> a) forcing of additional blood into the injured areas by pressure in injecting the embalming fluid, b) increased transparency of overlying skin resulting from perfusion with fixative, and c) reaction between some constituent in the embalming medium and blood tissue fluid with resultant formation of dark pigment complex.

Contusion becomes more apparent after the surrounding blood has been drained from

the tissues by lividity or embalming. Air embolism is never determined after arterial injection.

Cavity Embalming

Cavity embalming is done with a trocar before an autopsy or a hardening compound after an autopsy. The hardening compound is a formalin-impregnated sawdust-like material. The trocar is usually inserted into the abdomen and numerous thrusts are made into the heart, lungs, liver, intestines, and urinary bladder. The stomach, cecum, urinary bladder, and right atrium of the heart are targets of the cavity embalmer. Targets are aspirated of their contents prior to the injection of cavity fluid. After an autopsy, the intestines are perforated several times to release gases and allow absorption of cavity fluid or hardening compound. Trocar punctures in the skin are later sealed with trocar buttons. These punctures have been mistaken for stab wounds and shotgun wounds [*3*].

Building and Reducing

Reduction of swollen tissues may be accomplished by injections or surface applications of desiccating agents or electric heat applicators. Hypodermic injection of "tissue or feature builders" are applied to the eyeball and masseter muscles to alleviate sunken orbits and gaunt facies. Tissue builders are thickened embalming fluids. The recommended technique avoids injection directly into the eyeball, but the vitreous may be contaminated. The chemical composition of the tissue builder may complicate the toxicological analysis of vitreous humor.

To prevent rapid drying of the thin tissues of the scrotum, the embalmer may separately inject this area through the pubic hair or the scrotal sac to create the appearance of a hydrocele.

Positioning and Bindings

One hand is usually placed over the other on the chest. For a female with large breasts the arms may not be brought in this close. Sutures are placed through the nipples prior to the embalming and the breasts are pulled medially. Various mechanical devices, belts, and masking tape are used to hold the arms and breasts in position during embalming. The wrists and ankles are bound together. The presence of binding markings may suggest antemortem binding and questioning the embalmer may give a quick solution. The hands and fingers are taped together to prevent spreading. Wet binding material can impart a "washerperson's effect" to the hands. This effect can occur postmortem and should not suggest drowning.

Fractures of the extremities are reduced by the embalmer and placed in proper position before embalming. After the body is embalmed and rigidity firmly established, the detection of a fracture may be missed.

Preparation of the Head and Face

The eyes are closed with plastic eyecaps. These are available in a variety of types and sizes. Small perforations of the eyecaps produce a rough surface which holds the lids in position. Sometimes eye cement or "one-minute" glue is used to keep the eyelids in position. These should be removed as the eyes may show petechiae, pupil inequality, or jaundice disguised in the body by embalming fluid. The mouth is closed with a spring-activated injector that forces grooved steel needles into the mandible and maxilla. By means of wire attached to the needles, the mouth is fastened closed. The lips may be

sealed with glue or sutures. It seems plausible that dentures could be replaced over a gunshot wound to the roof of the mouth. The mouth is sealed and the orifices cleansed, and a nonperforating wound to the head may never be discovered by external examination.

After internal examination of the head has been done during an autopsy, the foramen magnum is packed to prevent leakage. Sometimes the basilar skull is filled with plaster of Paris to prevent leakage. Re-examination of the basilar skull after it has been filled with plaster of Paris is a formidable procedure.

Discussion

In 1956, Moritz [*6*] stated,

> The mistake of permitting a body to be embalmed before autopsy may be as disastrous as the performance of an incomplete autopsy. Even though the embalmer does not use a trochar, embalming invariably results in a wide variety of artefacts that tend to destroy or obscure evidence.

Embalmers, many pathologists, and other personnel still question the forensic scientists as to why a body should not be embalmed prior to examination. This report answers this problem by listing the mortuary procedures and itemizing the various artifacts that may be encountered. This should also help the concerned investigator to discriminate the fact from the fallacy.

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