RESTRAINT TECHNIQUES, INJURIES AND DEATH

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Introduction

A variety of methods are commonly used to physically restrain individuals taken into police custody, to control severely agitated persons, and to help manage the care of mentally or physically debilitated patients. The restraint process often results in injury to the person being restrained. Death, by a variety of causes, may occur while someone is restrained, prompting major forensic concern. With significant frequency the restraint is the cause of, or directly contributes to, the death of the individual being restrained.

Restraint-associated injury and deaths require in-depth investigation and careful interpretation.

Handcuffs

Handcuffs are the most commonly used restraint device employed by law enforcement agencies worldwide. It is standard policy for most law enforcement agencies to place a person being taken into custody into handcuffs, no matter how cooperative the person may be initially. The handcuffs are mostly metal devices, consisting of two hinged, mirror-image, circular-ratcheting, and self-locking pieces, one for each wrist. The two pieces may be joined by rigid metal pieces, hinged metal pieces, or metal chain. Standardized keys are needed to unlock each wrist piece individually. Use of flexible nylon or plastic wrist restraints is increasingly common. The most common of these devices consists of a single long, thin piece of synthetic material with one molded locking-device end and a tapered opposite end. The device is looped once around crossed wrists, the tapered end is inserted in the opening of the locking piece, and the free protruding end is pulled tight, closing the loop about the wrists. The flexible material is lightweight, strong, and inexpensive. Double-loop versions are also commercially produced. Most of these devices are intended for one-time use only, and must be cut to release.

Handcuffs may be applied with the arms of the restrained person in front or to the back; the latter technique is most commonly used as it limits the range of motion of the person's arms and hands, increasing security. Handcuffs are often joined to a chain that encircles the waist of the restrained person, also to limit arm mobility. A common chain may be attached to the waist chains in order to restrain several prisoners at the same time. This is also commonly accomplished by use of a series of handcuffs, one set of cuffs holding a prisoner's wrist to that of the next prisoner in line. Ankle restraints, similar in design to handcuffs and commonly called leg irons, with attached chains are often applied in addition to handcuffs during the transportation of prisoners. When in place, the restrained person can shuffle the feet, but does not have enough freedom of movement to walk or run in a normal fashion. A common chain between prisoners forming a work crew, the source of the expression "chain gang," may link leg irons.

Handcuffs may cause patterned abrasions around wrists (Figure 1), with parallel margins approximating the width of the cuffs, and are associated with wrist contusions of less specific shape. Leg irons produce similar injury patterns in the ankle areas.

Localized soft-tissue swelling at the site of handcuff application is common. Abrasions are often prominent at the radial and/or ulnar aspects of the wrists (Figure 2).

Figure 1 Handcuff injury.

Figure 2 Handcuff abrasions.

Compression neuropathies at the wrist may result from the application of handcuffs. Long duration of application of the handcuffs is the principal risk factor for the development of handcuff neuropathy. Intoxication by alcohol or drugs is also a predisposing factor. It has been estimated that 6% or more of prisoners who have been handcuffed experience some degree of compression neuropathy. The superficial radial nerve is most frequently involved. The radial nerve, the median nerve, or the ulnar nerve individually, or any combination of the three, may be injured by handcuff compression. Sensory impairment is common; numbness, paresthesias, and pain are typical symptoms. Motor deficits, with impaired grip, are less common than sensory impairment, but occur with significant frequency. When handcuff neuropathy occurs, involvement of both wrists is common. Neurologic deficits can persist for considerable periods of time, sometimes for years. Nerve conduction

studies may differentiate true handcuff compression neuropathy from other conditions or malingering.

While contusions, abrasions, and pain are often reported in association with the use of leg irons, significant neurologic impairment is uncommon. Falls while walking in leg irons may occur and result in an assortment of nonspecific contusions, abrasions, and lacerations, often involving areas of the body other than the ankles.

Carotid Sleeper Hold

Neck holds have been employed in modern times by police and prison personnel, but date back to martial arts teachings in past centuries. Use of neck holds is intended to subdue a physically violent person quickly. One technique involves the approach to the violent person from behind by the person attempting to place a subduing hold. The subduing person places his/her arm around the neck of the person to be subdued. The forearm is positioned in contact with one side and the front of the person's neck, and the biceps surface of the arm is positioned in contact with the opposite side and front of the neck. The subduing person pulls his/her arm and forearm together and backwards, squeezing the neck. The skin and soft connective tissues of the neck are compressed inward, causing the jugular veins and the carotid arteries also to be compressed. Blood flow through the carotid arteries is diminished or stopped entirely. While some blood flow to the head continues through the vertebral arteries, there is not enough blood flow to the brain to provide an adequate oxygen supply for full consciousness, and if the carotid sleeper hold is maintained, the person to which it is being applied loses consciousness and is rendered incapacitated, at least briefly. Once the carotid arteries are compressed to the point of occlusion, the person is expected to lose consciousness in 3–15 s. When properly applied, the carotid sleeper hold places little pressure at the anterior midline of the neck, and does not impair the airway.

The mechanism of action of the carotid sleeper hold is an ischemic/hypoxic insult to the brain, leading to loss of neural function. The mechanism is identical to manual or ligature strangulation, being an impairment of blood circulation to and from the head (and therefore the brain). The degree of dysfunction of the brain and any lasting brain damage or death depends directly on the duration of the carotid sleeper hold. As with any form of compression of the neck, pressure on the carotid bodies has the potential of inducing, through nervous system feedback to the heart, an arrhythmia-inducing sudden cardiac arrest and death. Precipitation of an ischemic stroke and promotion of a seizure are also potential risks of this type of neck hold.

Chokehold

Another type of hold applied to the neck is the chokehold. This maneuver involves placing the forearm transversely across the front of the neck and pulling backward; pressure is applied to the midline of the neck, resulting in compression of the airway. This restraint method is also referred to as the bar arm control. Airway compression causes pain and impairs the ability to breathe. Blood flow to and from the brain is generally not a significant factor. The pain and struggle to breathe may cause the person to fight the subduing person even more violently. Incapacitation occurs after the collapse of the airway has lasted long enough to cause hypoxia, and is not a rapid event.

When a chokehold results in crush injury to the airway, impairment of breathing may persist after the forearm pressure is released. The duration of hypoxia is the principal determination of degree of central nervous system injury that may follow the use of a chokehold. Acute airway obstruction may result in fulminant pulmonary edema. Hypoxia may exacerbate preexisting ischemic heart disease, resulting in myocardial infarction or cardiac dysrhythmias. Fatal hypoxic brain injury may result from application of a chokehold in the same way that death occurs from any other type of airway obstruction or suffocation. In cases of death following a chokehold, autopsy may reveal fractures to the thyroid cartilage. Injury to the cricoid cartilage and the rings of the trachea may also be identified. Irregular abrasions and contusions may be seen in the skin of the neck after forearm/arm holds have been applied.

Manual Body Restraint Holds

A variety of other manual methods may be used to subdue and maintain physical control over a violent, agitated person in the setting of a mental health facility, emergency room, jail, or street situation. One or more subduing persons may grasp the person to be subdued from behind, placing an arm over one shoulder and the chest. A "takedown" is done in the form of a partially controlled tripping of the individual's legs by the person grasping from behind or with the aid of another person. The individual is placed and held in a prone position, with the weight of the subduing person resting, in part, on the back of the person on the ground. Some degree of compression of one side of the neck is likely with this maneuver. A variation of this involves the person on the ground

being held by the wrists with his/her arms crossed over the chest. The person holding the wrists is positioned behind the person on the ground, applying some or most of his/her weight to the back. Pulling on the wrists controls the person's arms. This is sometimes referred to as a "therapeutic basket hold." While far less common than in the past, a straitjacket may still occasionally be used to control a mental patient, putting the patient's arms in a cross-chest position, similar to the basket hold.

When multiple individuals are participating in the takedown and control of one agitated person, it is common for each of the person's limbs to be grasped and controlled by one or more subduing individuals. It is not uncommon when dealing with a particularly violent person that a "piling on" occurs, with multiple individuals holding the limbs and others grasping the person from behind. The person ends up prone on the ground at the bottom of the pile, with the weight of multiple people on his/her back. Neck holds may be used as a part of the takedown process.

A variety of nonspecific contusions and abrasions can occur during a takedown and the application of manual holds to maintain control of an individual. Blunt injuries to the face and anterior chest are common, due to the person ending up in a prone position in contact with the ground. Neck compression and partial or complete impairment of the airway or blood circulation to the head may occur. If the restrained person is held prone on a relatively soft surface (e.g., thick carpet, dirt, bedding, or couch cushion) obstruction of the nose and mouth may occur, resulting in some degree of suffocation. Maintaining weight on the subdued person's back can result in mechanical asphyxia. Combinations of these mechanisms are at play in many cases. Death from this mode of restraint, with weight on the back producing mechanical asphyxia, has occurred following the holding of a person for as little as 4 min. Mechanical asphyxia may also result from very tight application of a straitjacket.

Restraint Chair

An unruly or violent person may be confined to a sitting position in a chair equipped with restraint straps. The arms, legs, and trunk of the individual are each secured to the chair. The head may also be secured in some fashion. When fully secured in a restraint chair, the person is effectively immobilized and has little chance of hurting him/herself, or anyone else. Contusions and abrasions may result from the person struggling with arms or legs against the straps.

If immobilization by any form of restraint is maintained for a significant period of time, there is a risk of development of deep-vein thrombosis, particularly in the legs, and subsequent pulmonary thromboemboli.

Restraint Belts and Vests and Bedrails

It is common practice to restrain hospital and nursing facility patients with an abdominal restraint belt or a restraint vest (also called a "posey"). The belt or vest is secured to the wheelchair, the fixed chair, or the patient's bed. The restraints stop patients from ambulating. The intention is to prevent injury from a fall or to keep the person from wandering away and getting lost. Metal bedrails (side rails) are often used in hospital-type beds to prevent a patient from falling out of bed to the floor.

Restraint vests may result in shoulder compression sufficient to cause brachial plexus injury with varying degrees of persistent nerve function impairment. Belt and vest restraints do not prevent all movement of the patient, and the patient may slide or partially fall from a chair or bed in such a way that much of the body weight is suspended by the belt or vest. The belts can migrate upward and compress the chest; fatal mechanical asphyxia may result. The upper edge of the vest can compress the neck, causing fatal strangulation. Entrapment of patients in bedrails or between the bedrails and the mattress has led to fatal mechanical asphyxia and strangulation.

Excited Delirium

Various forms of mania characterized by marked physical agitation often lead to an individual being physically restrained by others. Physical violence against others and bizarre behaviors, such as running naked through traffic, are often seen in such cases. "Excited delirium" or "agitated delirium" are apt descriptors of the condition. Schizophrenia, other mental disorders, and drug or alcohol intoxication are associated with excited delirium. Cocaine, methamphetamine, and phencyclidine (PCP) have frequently been identified in drug-associated cases. Hallucinogenic drug use (e.g., lysergic acid diethylamide (LSD) and mescaline) may also be associated with excited delirium, although laboratory detection is more difficult than with the more commonly encountered drugs; routine toxicology screening may yield false-negative results.

Excited delirium is observed to be associated with an apparent increased pain threshold; individuals seemingly are unaware of injuries in many cases, and may not react to a delivered blow (such as being struck with a police baton or "night stick") as a normal person would. The degree of agitation is often such that an individual ignores commands and

is able to resist the efforts of multiple people to subdue him/her, literally throwing people off his/her back in some instances.

The agitation and violent actions of individuals in a state of excited delirium frequently result in the person sustaining a multitude of contusions, abrasions, lacerations, and cuts. The injuries often occur both well before and during efforts to restrain them. The extremities, the face, and the scalp are usually involved, with no particular pattern recognized. The marked degree and duration of excited delirium may result in considerable physical exertion, with associated changes in heart rate and blood pressure, oxygen debt, metabolic acidosis, and catecholamine release.

Hobble Restraint

Because of the extreme agitation that is often associated with excited delirium, a person may have restraint devices applied to both the arms and the legs in order to be adequately controlled. Hobble restraint is used in reference to a variety of restraint techniques intended to limit a person's leg movements. Commonly this refers specifically to the simultaneous use of handcuffs and leg restraints, a technique that is also called "hog-tying." Hog-tying involves handcuffing a person's wrists behind the back and binding the ankles together. The wrists and ankles are then pulled together and tied to one another. The person most often ends up in a prone position (Figure 3). The person putting the handcuffs and ankle bindings on the person being restrained often places a knee, and weight, on the back of the individual during the process, resulting in chest compression.

The hobble restraint results in constant pressure on both the wrists and the ankles. Pain, contusions, and abrasions at the wrists and ankles are common. There are numerous cases of people dying while being subjected to hobble restraint. Research into the possible mechanisms contributing to such deaths has been conducted. Statistically significant decreases in mean forced vital capacity and mean forced expiratory volume (restrictive pattern of impaired pulmonary function) has been found in healthy volunteers subjected to hobble restraint in the prone position. Changes in heart rate and blood pressure have also been observed. Two independently conducted studies have shown that recovery of heart rate (pulse rate) following exercise can be prolonged (statistically significant differences) when a person is restrained in a face-down (prone) position, compared to other positions. The characterizations of research findings vary from "not associated with any clinically relevant changes" to "dramatic impairment of hemodynamics and respiration." Further research is urgently needed in this area.

Figure 3 Hobble restraint position.

Investigating Restraint-Associated Deaths

When a person who has been restrained is pronounced dead, the death scene should be immediately secured and the body and all items on the body should be left as they are. A trained death investigator should examine the body and all items on the body at the scene. The body and all restraint devices (and all other items) on the body should be photographed and packaged together as evidence. When police were directly involved in the restraint of a person who dies, a scene response by the medical examiner, the coroner, or one of his/her representatives (medical investigator or deputy coroner) is warranted and should be made as quickly as possible. If restraint devices have been removed for any reason prior to the arrival of the death investigator, the items need to be found, taken into evidence, photographed, and examined in detail.

An experienced forensic pathologist should perform a thorough autopsy. Anterior and posterior neck dissections and dissection of the back are recommended to search for injuries that may not be seen at the skin surface. Toxicology is essential, even if drug use history is unknown. Photographs should be taken, recording all areas of the body, even when no injuries are visible. Radiographs (X-rays) should be considered. The deceased's medical history should be ascertained.

An effort to develop a timeline of the activities and actions of the deceased and all individuals involved in the restraint should be made. Surveillance photographs or video images may be available and should be reviewed. Videos should be timed.

Deductive reasoning and a detailed knowledge of the facts of a particular case are needed in order to draw appropriate conclusions as to the cause and manner of an individual's death. Inductive reasoning is to be avoided; the isolated extrapolation of any one

animal or human study or case report to the investigation of a particular restraint-associated death is unwise. Statements made by those involved in the restraint must be evaluated carefully; there is a tendency to underestimate both the amount of force used and the duration of the restraint.

Neural inducement of cardiac arrhythmias, catecholamine release and toxicity, rhabdomyolysis, impaired breathing, impaired blood circulation, metabolic acidosis, coexisting natural disease, blunt and sharp injuries, and drug toxicity should all be given consideration in identifying mechanisms of death in cases involving restraint. If one or more physiologic effects stemming from restraint are considered to contribute to death, then the physical restraint should be identified as the cause or one of the causes of the death. If restraint is identified as one of the causes of death, the manner of death should be classified in an unnatural category, even if natural disease is present. Suicide is not applicable when restraint is applied by someone other than the deceased, leaving accident, homicide, or undetermined (or unclassified) to be used to define the action leading to death, according to the circumstances of the individual case.

The fact that a person was in a hobble restraint (hog-tied) is not sufficient evidence by itself to conclude that fatal asphyxia occurred. However, the multitude of physiologic effects of restraint should not be underestimated or quickly dismissed as making a contribution to death, just as modest changes in heart rate and blood pressure recorded in test subjects in controlled low-dose cocaine studies should not lead one to conclude that cocaine is never toxic and not a causative factor in some deaths. Knowing the morbid anatomy in a particular case alone will not allow for proper understanding of the death; physiologic alterations must be taken into account. Restraint need not produce systemic hypoxia to contribute to death. Restraint stress, not just the possibility of asphyxia, must be given due consideration. Following careful investigation, most restraint-associated deaths are determined to be multifactorial.

Police and others using restraint techniques must be aware of and trained in the possible risks of all types of physical restraint, and to monitor closely individuals who are being restrained by any method. If there is any doubt about the restrained person's condition, emergency medical services should be summoned immediately to evaluate and treat as needed.

See Also

Custody: Death in, United Kingdom and Continental Europe; Death in, United States of America; **Detainees:** Care in Police Custody, United Kingdom; Care in Prison Custody, United Kingdom; **Excited Delirium**; **Injuries and Deaths During Police Operations:** Special Weapons and Training Teams

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Restraint, Excited Delirium *See* **Excited Delirium**; **Substance Misuse:** Cocaine and Other Stimulants