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Mini Review

# Mini Review on Injuries Caused by Sharpe Objects

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## Abstract

In general, the same morphologic principles are used in both the forensic assessment of sharp force injuries in living and dead people. However, there are several unique characteristics of sharp force injuries that must be taken into account when examination findings on the living are interpreted to distinguish between accidental origin, self-infliction, or murderous assault. These include the frequency and localisation of defensive injuries, the perpetrator's injuries, and manufactured injuries, particularly those caused with the intention of defrauding insurance companies. This article covers the characteristics and alternative diagnoses of "clinical" sharp force injuries.

**Keywords:** Sharp force • Artificial injuries • Clinical forensic medicine • Knife attack • Defence injuries

## Introduction

The general public has only recently come to understand the significance of forensic examinations of living people, despite the fact that so-called "clinical" forensic medicine has always been one of the traditional subfields of forensic medicine. Therefore, it is not surprising that this unique sphere of action is covered in the pertinent textbooks that were written around the end of the 19th century. In general, the forensic autopsy examination of a corpse and the medicolegal evaluation of injuries in a living person are founded on the same concepts and have similar questions to be addressed. Particularly in criminal proceedings, the expert opinion must include information on the type of injuries, the potential causative instrument, the mechanism of harm and the sequence of events, as well as the seriousness of the injuries sustained. The correct collection and documenting of findings is another crucial component. Pollak provides an overview of the fundamentals and legal considerations surrounding the clinical forensic assessment of injuries. According to the study materials of the Freiburg Institute of Legal Medicine, 10–20% of the entire yearly number of clinical forensic exams, which are often conducted in connection with offenses of bodily injury, are devoted to evaluating sharp force injuries. Sharp force accounted for 28% of all injuries in a Canadian study on juvenile violence involving 4100 teenagers between the ages of 14 and 19 years, making it the second most common cause of injury after blunt trauma with a rising trend. The use of sharp force by the perpetrator in sexual offenses or child abuse is less frequent; if cuts and/or stab wounds are discovered in such situations, they are typically linked to wounds from other types of violence. The mechanism of injury is the key question to be addressed while studying living people, much like in forensic autopsies. It is frequently possible to distinguish between homicidal assault, self-inflicted injury, and accidental origin with the proper interpretation of the full pattern of findings [1]. The interpretation of the results can be aided by numerous publications that cover various facets of sharp force trauma. Numerous studies have focused on the question of how to distinguish between self-infliction and outside interference, and many authors have attempted to identify suggestive characteristics separate from the actual damage pattern. The pertinent textbooks contain in-depth analyses of the pure morphology and pattern of wounds in sharp force injuries. The majority of the research on sharp force injuries that is currently accessible is based on postmortem data. Only a few articles in the past specifically addressed the pattern of sharp force injuries in living people. Some of these publications looked at the perpetrators as well as the victims. Clinically relevant research naturally focuses on many topics, primarily mortality and treatment or epidemiology and prevention. In addition, there are many case reports. Typically, these researches and case reports do not distinguish between injuries based on forensic factors. The location of lesions is frequently merely mentioned in generic terms, such as "the left arm," "the right arm," or "the extremities." Additionally, forensically significant elements, such as the presence or absence of defense injuries, are frequently not stated in detail. Due to this, it is frequently impossible to meaningfully compare studies conducted by thoracic surgeons and medicolegal experts. The forensic interpretation of data in the clinical environment is susceptible to certain characteristics that must be taken into consideration, even though the medicolegal evaluation of sharp force injuries in corpses and living people follows the same general guidelines. The following section will go over these qualities.

The complex nature of sexual assault includes, among other things, the use of psychoactive substances, including prescription and illicit medications, medical treatments, and other substances. Psychoactive chemicals have frequently been used to mediate sexual intercourse throughout history. However, if social changes take place and have an impact on purchasing habits and sexual contact, this mediation may need to be modified. With the gender gap narrowing in recent decades, numerous studies have noted considerable changes in female spending patterns, particularly among younger women. The phenomena of substance-mediated sexual violence, also known as drug-facilitated sexual assault, is a result of the interaction between sexual violence and the use of psychoactive substances. 11% of American women over the age of eighteen have been sexually assaulted while under the influence of alcohol or drugs at some point in their life, and 1% have happened within the past year. In the UK, 38% of victims who indicated they had been raped at least once before the age of 16 reported being drunk at the time of their most recent rape. Depending on the attacker's modus operandi, DFSA victims might be classified as either proactive or opportunistic. In opportunistic assaults, the attacker takes advantage of the victim's voluntary intoxication-induced condition of incapacity [2].

An important requirement of proof indicating the involvement of another person is defense injuries. They can be very detailed in demonstrating that someone was struck with a sharp object.

Additionally, they show that the victim was able to resist the attack and was initially aware. The distinction between "passive" and "active" defense injuries that is typically made in German-speaking nations is frequently criticized because it is based on a rather stereotypical idea of the relationship between the victim and the perpetrator: hands "actively" grasping the knife or sharp-edged tool to ward off the stab with injuries on the flexor sides of the forearms and hands. Many authors avoid using this conventional classification because it fails to adequately account for the dynamics of the altercation and the multiple opportunities for interaction between the victim and the offender [3-4].

The phrase "defense injuries" is used in this article. The most common defense injuries caused by sharp force are cuts on the hands, followed by cuts on the forearms, stabs on the forearms, and stabs on the hands;

perforations can also happen. As previously indicated, defense injuries are more frequently found on the palms, flexor sides of the fingers, and interdigital regions than on the extensor sides of the forearms and hands [5]. They are most frequently observed in the first intermetacarpal space, the thumb, the index finger, and the relevant metacarpal regions I and II. Defense injuries occurred between 37% and 49% of the time in different research on postmortem cases. Studies that used a relatively small sample size or pre-selected material revealed lower numbers ranging between 6% and 32%. The absence of defense injuries does not, therefore, necessarily rule out a murderous assault. When survivors of sharp force attacks are examined, defense injuries are discovered in nearly 46% of cases, which is a fair amount of the time. However, it becomes clear from comparing survivors and dead victims that survivors with only one single injury to the trunk experienced additional defense injuries in a disproportionally high number of cases (28%), whereas additional defense injuries were only discovered in 3-8% or 15% of victims killed by a single stab or cut wound to the head, neck, or trunk. The number of additional defense injuries rises with each strike to the body, affecting both survivors and dead victims [6]. All surviving victims who had eight or more body blows had additional defense wounds. However, the likelihood of surviving such an attack substantially decreases with more body impacts, particularly to the thorax. The predominance of defense injuries on the left side, which is usually suggested for deceased victims, cannot be proven in the cases of those who survived the attack. This is another distinction between those who survived and those who were killed by sharp force. The belief that this area of the body is closer to the predominantly right-handed offender explains why two-thirds of all defense injuries were discovered on the left arm or left hand in autopsy examinations. The study, which only had 14 deceased people with defensive wounds, stands out as an outlier. Although the left part of the body, including the left upper arm, was once more hit more frequently, the distribution of defense injuries on the left and right sides was generally similar in the survivors. It appears likely that the motivation of the offender may have a considerable impact on the victim's pattern of injuries and that crimes involving bodily harm from blunt force are not always unfinished "minor forms" of homicide [7-9].

Although it is challenging to analyze the perpetrator's motivations on the basis of the victim's injury pattern, a separate classification seems fair. This is further confirmed by the observation that some knife attack survivors exhibit defensive wounds but no additional stab or cut wounds on other body parts. This may occur if the assailant primarily utilizes the weapon to threaten the victim or if he is significantly restricted in his ability to act, such as because of the small amount of space available. In fact, it is reasonable to believe that a significant number of people have been hurt in this way, but as trial history demonstrates, forensic experts hardly ever investigate these victims. The attacker may unintentionally cut his own hands during knife attacks. In the literature to date, accidental (self-inflicted) injuries of the offender in conjunction with knife attacks have been studied only infrequently. The likelihood of cut wounds on the offender is marginally higher on the left hand than on the right; preferable sites - without any statistical significance are the (proximal and) distal interphalangeal joints of the right index finger, the thenar, and the radial side of the left thumb. It was impossible to show that the criminals under investigation had sustained defensive injuries to the first intermetacarpal space, which are commonly found in victims holding the weapon. Pathognomonic injuries to the perpetrator's hand cannot be broadly generalized based on the evidence currently available, although certain damage patterns do allow for trustworthy reconstructions [9-10].

If the knife used does not have a sufficient handguard and the point of the blade strikes a solid resistance and is thus abruptly decelerated, characteristic lesions may develop on the hand of the culprit wielding the weapon. This could happen, for instance, if it strikes a solid textile or bony part of the victim, especially if sweat or blood reduces friction between the attacker's palm and the knife's grasp. Even a submaximal stimulus is sufficient in these circumstances. If the offending weapon is still available, a bent blade or broken tip may offer important hints.

The injuries on the attacker's hand will have the following observable characteristics when the stab is performed with the blade protruding on the ulnar side of the fist: On the flexor side of the hand, the lesions are roughly transverse to the longitudinal axis of the fingers; if multiple fingers are affected, the injuries appear to be arranged in steps when the fingers are extended; the little finger is typically affected, and the depth and severity of the wounds decrease from ulnar to radial. The only impacted hand when wielding the knife is the dominant hand [11-13]. Sometimes, the wounds of knife attack and suicide victims resemble one another. But the radial side of their injuries is where they are most frequently found. Frequently, the little finger is unaffected, or the opposite (non-dominant) hand has additional wounds. If a double-edged blade is used and the knife is held with the blade projecting on the radial side, injuries could happen to the thumb, index finger, or possibly both. The flexor tendons of the fingers may also be severed if the wounds are deep enough; in this case, severely retracted tendon stumps indicate that the muscle was tensed or the fist was tightly closed at the time of impact. The position of the fingers and the muscle tone at the time of severance, in accordance with the experience of hand surgeons, determine the localization of the tendon stumps, which frequently need to be recovered at a greater distance from the skin wound, if the finger was flexed at the time of the injury. The musculotendinous unit contracts more quickly if the tendon is damaged when the muscle is under strain [14]. The tendons of the deep finger flexors are more frequently harmed because of their anatomical position. If the lateral ligament structures, the vincula tendinum, are still present, a check-rein mechanism limits the retraction of the proximal tendon stump within the tendon sheath. As a result, the finger flexor tendons' vincula brevia can support up to 69% (DIP) or 93% (PIP) of joint flexion. Recent research on the biomechanics of the vincula tendinum shown that this structure can withstand a maximum strain of roughly 27 N before breaking. This means that if the flexor tendon ruptures while it is tightened, such as when the fist is tightly closed, the proximal tendon stump will retract greatly.

The medicolegal assessment of isolated hand wounds in the absence of any additional injuries is still challenging, nevertheless. It will only occasionally be possible to distinguish between the victim and the offender based solely on a single injury of this kind [15].

## Conclusion

Self-inflicted or artificial injury is another unique type of sharp force injuries typically seen at forensic examinations in the therapeutic context. Less frequently occur self-inflicted injuries caused by heat or blunt force. Numerous case reports and review articles have both addressed the topic. Artificial injuries are frequently discovered in connection with fabricated offenses, particularly sexual assaults or assaults, attempted insurance fraud, and in individuals with mental illnesses or personality disorders, particularly borderline personality disorder, as "dermal artifacts." Attacks with a political motivation are feigned less frequently. The clinician's ability to recognize fake injuries is crucial for effective patient management, especially if a forensic specialist cannot do an assessment. In the pertinent textbooks, the morphological appearance of artificial injuries is thoroughly documented. The wounds are typically of uniform shape, linear or slightly curved, often grouped and/or with a parallel and/or crisscross arrangement, and they follow the body surface even where it is curved. Additionally, the injuries are either distributed symmetrically or are preferably localized on the nondominant side of the body (typically the left) in easily reachable body receptacles. Clothing damage is either nonexistent or inconsistent. Scars from prior self-harming behavior can occasionally be seen, for example on the forearms. Artificial wounds that don't exhibit the aforementioned morphological characteristics are significantly more challenging to identify, such as self-inflicted stab wounds (to the chest or belly) used to mimic an assault. The aftereffects in these situations may be severe or even lethal. The presence of hesitation marks frequently aids in accurate diagnosis. It might be challenging to identify artificial wounds that people with medical training intentionally produce to themselves, for instance if local anesthetics or surgical equipment have been used. Younger people in their second or third decade of life typically, but not always, inflict artificial wounds to represent an offense.

The main goal is to gain favor with others, win their love, or control those who are close to them. One must be cautious when disclosing the self-infliction or confronting the patient with it because the lesions they create could be an indication of an acute life crisis. If the patient exhibits acute or latent suicidal impulses, mental intervention may occasionally be necessary. Additionally, the appearance of fake lesions does not always disprove that the individual was the victim of a crime. There have been instances of self-destructive behavior following actual sexual assaults or persistent maltreatment. Last but not least, it is necessary to bring up the artificial injuries caused intentionally in order to

commit insurance fraud, in which the perpetrator attempts to collect money from one or more insurers by faking an accident. Typically, the injury committed for this reason involves self-mutilation, such as the removal of a hand or finger from the body. Axes, hatchets, circular saws, and chainsaws are frequently utilized because of their sharp edges. The circumstances of the case will frequently make it difficult to prove self-mutilation, but the pattern of the injuries may also give insights. The left side of the body or the non-dominant hand receives more than 90% of all purposeful self-mutilations. There may occasionally be hesitant cuts seen close to the amputation incision. The area around the amputation wound may have cuts. The index finger is by far the most frequently affected site among doctors, with total amputation of the thumb coming in second most frequently. These preferences can be attributed to the terms of general accident insurance, which call for special payments in the event that specific body parts are lost or cease to function (the "dismemberment schedule"). The location of the wound (distal phalanx/finger tips versus proximal phalanx), the site of the amputation in relation to the longitudinal axis of the finger (diagonal to almost parallel versus transverse to the longitudinal axis of the finger), and the severity of the lesion (often "only" soft tissue lesion versus complete amputation) also differ between accidental and purposeful injuries to the fingers. The reconstructed posture of the hand at the time of receiving the injury in self-mutilations frequently looks illogical.

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## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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