Forensic Science International 195 (2010) 1–5

Contents lists available at ScienceDirect

Forensic Science International

journal homepage: www.elsevier.com/locate/forsciint

Review

# Sharp force injuries in "clinical" forensic medicine

Ulrike Schmidt *

*Institute of Legal Medicine, University Hospital of Freiburg, Albertstr. 9, 79104 Freiburg, Germany*

ARTICLE INFO

*Article history:*
Received 17 August 2009
Received in revised form 1 October 2009
Accepted 25 October 2009
Available online 24 November 2009
Dedicated to Prof. Dr. Drs. h. c. S. Pollak on the occasion of his 60th birthday.

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

ABSTRACT

In general, the forensic evaluation of sharp force injuries in living and dead individuals follows the same morphologic principles. Still, there are some special features of sharp force injuries in the clinical context, which have to be considered as examination findings on the living are interpreted to differentiate between accidental origin, self-infliction or homicidal assault. These include the frequency and localization of defence injuries, injuries of the perpetrator, and artificial injuries, especially those inflicted for the purpose of insurance fraud. Characteristics and differential diagnoses of "clinical" sharp force injuries are surveyed in this article.



**Contents**



## 1. Introduction

Only in the last few years has the importance of the forensic examination of living individuals been realized by the general public, although the so-called "clinical" forensic medicine has always been one of the classical fields of forensic medicine [1,2]. It is therefore not surprising that already the relevant textbooks published around the end of the 19th century deal with this special field of activity [e.g. 3–5]. Generally, the medicolegal evaluation of injuries in a living individual is based on the same principles as the examination of a corpse at forensic autopsy and the questions to be answered are similar [6]. The expert opinion has to contain statements on the kind of the injuries and the possible causative instrument [7,8], the mechanism of injury and the course of events as well as the severity of the injuries suffered—especially in criminal proceedings [9]. Another essential aspect is the proper collection and documentation of findings [10,11]. A survey of the general and legal aspects of the clinical forensic evaluation of injuries is given by Pollak [9].

In the study material of the Freiburg Institute of Legal Medicine, the evaluation of sharp force injuries accounts for 10–20% of the total annual number of clinical forensic examinations, which are usually performed in connection with offences of bodily injury. In a Canadian study on juvenile violence including 4100 adolescents

* Tel.: +49 761 203 6830; fax: +49 761 203 6858.
*E-mail address:* ulrike.schmidt@uniklinik-freiburg.de.

0379-0738/$ – see front matter © 2009 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.forsciint.2009.10.031

aged 14–19 years, sharp force accounted for 28% of all injuries and was thus the second most common cause of injury after blunt trauma with a growing tendency [12]. In sexual offences or child abuse, the use of sharp force by the perpetrator is less common; if cuts and/or stabs are found in such cases, they are mostly associated with injuries caused by other forms of violence [13,14].

As in forensic autopsies, the mechanism of injury is also the decisive question to be answered when examining living individuals. In many cases, the correct interpretation of the entire pattern of findings (i.e. localization, number, distribution and morphology of the individual lesions, severity of sequelae) allows to differentiate between accidental origin, self-infliction or homicidal assault. Numerous publications covering different aspects of sharp force trauma can help with the interpretation of the findings. Extensive investigations have been conducted especially on how to differentiate between self-infliction and involvement of another party [e.g. 15,16], and many authors tried to define indicative variables apart from the actual injury pattern [e.g. 16–18]. Comprehensive surveys of the pure morphology and wound pattern in sharp force injuries can be found in the relevant textbooks [e.g. 9,19–21].

Most of the currently available studies on sharp force injuries are based on autopsy material. An overview is given by Bohnert et al. [22]. In the past, only a small number of papers explicitly dealt with the pattern of sharp force injuries in living individuals. In some of these papers, not only the victims, but also the perpetrators were examined [23–26]. Corresponding studies performed by clinicians naturally focus on different aspects, mostly epidemiology and prevention [e.g. 12,27] or therapy and mortality [e.g. 28,29]. Moreover, there are numerous case reports. Usually, these studies and case reports do not differentiate injuries under forensic aspects. The localization of lesions is often described only in general terms, e.g. "the left arm", the "right arm" or simply the "extremities" [27,29]. Also, forensically relevant aspects are not specifically mentioned in most cases, e.g. the presence or absence of defence injuries [23,29]. For this reason it is often impossible to make a meaningful comparison between medicolegal studies and, e.g., studies performed by thoracic surgeons.

Although the medicolegal evaluation of sharp force injuries in corpses and living individuals follows the same principles, the forensic interpretation of findings in the clinical context is subject to certain characteristics, which have to be taken into consideration. These characteristics will be discussed in the following.

## 2. Defence injuries

Defence injuries are a crucial criterion of evidence for the involvement of another person. They are highly specific in proving that a person was attacked with a sharp instrument [15]. Moreover, they demonstrate that the victim was – at least initially – conscious and able to ward off the assault [30]. The distinction usually made in the German-speaking countries between "passive" and "active" defence injuries is often criticized [30,31], as it is based on a rather stereotyped idea of the interrelation between the victim and the perpetrator: arms "passively" raised for protection with subsequent injuries on the extensor sides of the forearms and hands versus hands "actively" grasping the knife or sharp-edged tool to ward off the stab with injuries on the flexor sides of the hands [20,32,33]. Since this differentiation does not sufficiently take into account the dynamics of the fight and the numerous possibilities of interaction between the victim and the perpetrator, many authors do not use this traditional categorization [30,32,34]. In this article, the term "defence injuries" is used.

Defence injuries due to sharp force most frequently present as cuts on the hands followed by cuts on forearms, stabs on forearms, and stabs on hands; perforations can occur [30,32,35]. As already mentioned, defence injuries are localized either on the extensor sides of the forearms and hands or – more often – on the palms, the flexor sides of the fingers and the interdigital spaces [30,32,36]. They are seen particularly often in the region of the thumb, the index finger and the pertinent metacarpal regions I and II, and especially the first intermetacarpal space [19,32]. In several studies on autopsy cases, the incidence of defence injuries was between 37% and 49% [18,32,35,37–40]. Lower figures ranging between 6% and 32% were reported in studies conducted on a very small number of cases or pre-selected material [41–43]. Consequently, the absence of defence injuries does by no means rule out a homicidal assault [15,30,32].

In surviving victims of sharp force attacks, defence injuries are found in almost 46% of cases—and thus relatively often [25]. However, when comparing surviving and killed victims it becomes evident that survivors with only one singular injury of the trunk suffered additional defence injuries in a disproportionately large number of the cases (28%) [25], whereas in victims killed by a singular stab or cut wound to the head, neck or trunk, additional defence injuries were found only in 3–8% [32,34,40] or 15%, respectively [38]. With an increasing number of hits to the body, the number of additional defence injuries increases both in surviving and killed victims [32,34,35,40]. All surviving victims who took 8 or more hits to the body showed additional defence injuries [25]. However, with an increasing number of body hits – especially to the thorax – the chance to survive such an attack drops dramatically [27,29].

Another difference between surviving and killed victims of sharp force is that the predominance of defence injuries on the left side frequently postulated for killed victims cannot be demonstrated in the victims surviving the attack [25]. The fact that in the autopsy studies about two-thirds of all defence injuries were found on the left arm or left hand [32,40], is explained by the assumption that this part of the body is closer to the mostly right-handed perpetrator [30,32]. An exception is the study by Bajanowski et al. [41], which included only 14 killed individuals with defence wounds, however. In the surviving victims, the distribution of the defence injuries on the left and right side was relatively similar, although the left half of the body – including the left upper arm – was again hit more frequently [25,27].

It seems likely that the perpetrator's motivation may significantly influence the victim's pattern of injury and that offences of bodily injury due to sharp force are not always uncompleted "minor forms" of homicide [23,25,34]. A separate categorization appears to be reasonable although motivational factors on the part of the perpetrator are difficult to objectively evaluate on the basis of the victim's injury pattern. This is also supported by the fact that some victims surviving a knife attack show defence injuries, but no additional stab or cut wounds on other parts of their bodies. This may happen if the attacker uses the weapon primarily to threaten the victim or if he is severely handicapped in his ability to act, e.g. due to the limited space available [25]. In fact it is to be assumed that the number of individuals injured in this way is rather high, but, as the experience in the courtroom shows, that they are rarely examined by a forensic expert.

## 3. Injuries of the perpetrator

In knife attacks, the assailant may also unintentionally cut his own hands. Accidental (self-inflicted) injuries of the perpetrator in connection with knife attacks have rarely been discussed in the literature so far [24–26]. The incidence of cut wounds on the offender is slightly higher on the left than on the right hand; preferential regions – without any statistical significance – are the radial side of the left thumb, the left thenar and the (proximal and) distal interphalangeal joint of the right index finger [25]. Defence